DOCUMENT RESUME

ED 043 769 24 VT 011 851

AUTHOR Fuller, William P.
TITLE Education, Training and Productivity: A Study of Skilled Workers in Two Factories in South India.
INSTITUTION Stanford Univ., Calif. Stanford International Development Education Center.
SPONS AGENCY Office of Education (DHEW), Washington, D.C. Bureau of Research.
BUREAU NO BR-6-2597
PUB DATE 70
CONTRACT OEC-4-7-062597-1654
NOTE 138p.
AVAILABLE FROM Publications Secretary, SIDEC, School of Education, P.O. Box 2329, Stanford University, Stanford, California 94305

EDRS PRICE EDRS Price MF-$0.75 HC-$7.00
DESCRIPTORS Ability, Environmental Influences, *Foreign Countries, *Job Training, Off the Job Training, On the Job Training, *Productivity, *Skilled Occupations, Task Performance, *Trade and Industrial Education, Work Experience
IDENTIFIERS *India

ABSTRACT

To examine the contributions of specific kinds of occupational training to the productivity of workers with different levels of formal schooling, interviews were used to collect data on general education, trade training, work experience, environmental characteristics, and general ability from 598 turners, millers, and grinders in two factories in Bangalore, India. There were significant differences in the productivity of workers with different kinds of training, but the best producers were workers with similar levels of education and environmental backgrounds and with mainly informal in-plant training. Workers who had formal training in technical schools were promoted within skilled occupational categories more rapidly than workers with primarily in-plant training, which suggests that promotion is determined more by a certificate of qualification than by actual job performance. The differences in productivity between workers with primarily outside training and other workers seem to reflect differences in attitudes and behavior unrelated to job knowledge and skill. (SB)

BRG 2547
PA 24

ED043769

EDUCATION, TRAINING AND PRODUCTIVITY: A STUDY OF SKILLED WORKERS IN TWO FACTORIES IN SOUTH INDIA

By William P. Fuller

OET-7

VT011851

a publication of the

STANFORD INTERNATIONAL DEVELOPMENT EDUCATION CENTER (SIDEC)

SCHOOL OF EDUCATION

STANFORD UNIVERSITY

ED043769

EDUCATION, TRAINING AND PRODUCTIVITY: A STUDY OF SKILLED WORKERS IN TWO FACTORIES IN SOUTH INDIA

By William P. Fuller

OET-7

The research reported herein was performed pursuant to a contract titled "The Content and Instructional Methods of Education for the Economic-Political-Social Development of Nations" (Contract Number OEC-4-7-062597-1654) with the Office of Education, U.S. Department of Health, Education, and Welfare, which supported the publication of this case study.

Contractors undertaking such projects under Government sponsorship are encouraged to express freely their professional judgment in the conduct of the project. Points of view or opinions stated do not, therefore, necessarily represent official Office of Education position or policy.

Stanford International Development Education Center (SIDEC)

School of Education

Stanford University

Stanford, California, U.S.A.

1970

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION
THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL OFFICE OF EDUCATION POSITION OR POLICY.

SIDEC STUDIES ON CONTENT AND METHODS OF EDUCATION FOR DEVELOPMENT

Sub-series on Occupational Education and Training

OET-1. Planning Occupational Education and Training for Development, by Eugene Staley. 1968.

OET-2. Occupational Education and Training for Development: An Account of the International Workshop Held July 24 through August 5, 1967, at Stanford, California, by Marian Alexander-Frutschi, Editor. 1968.

OET-3. Issues in Occupational Education and Training: A Case Study in Jordan, by Najati Al-Bukhari. 1968.

OET-4. Issues in Occupational Education and Training: A Case Study in Tunisia, by Najati Al-Bukhari. 1968.

OET-5. Education and Training for Industrial Development in India, by B. S. Venkata Rao. 1969.

OET-6. Factors Associated with the Migration of High-Level Persons from the Philippines to the U.S.A., by Josefina R. Cortés. 1970.

OET-7. Education, Training and Productivity: A Study of Skilled Workers in Two Factories in South India, by William P. Fuller. 1970.

Sub-series on Education and the Formation of Social and Civic Attitudes

ESCA-1. Attitudes and Behavior of Teachers in Uganda: An Aspect of the Process of National Development, by David R. Evans. 1969.

ESCA-2. Education and National Development in Colombia, by Joaquín Páez-Gómez. 1969.

ESCA-3. Education and Modernization in Micronesia: A Case Study in Development and Development Planning, by Richard Pearse and Keith A. Bezanson. 1970.

ESCA-4. The Impact of University Social Structures on Student Alienation: A Venezuelan Case Study, by Robert F. Arnove. 1970.

Sub-series on Education and the Rural-Urban Transformation

ERUT-1. The Provincial School Superintendent in Thailand: A Study of Role Perceptions and Expectations, by Pinyo Satorn. 1970.

Information about these publications, including handling and shipping charges, may be obtained by addressing the Publications Secretary, SIDEC, School of Education, Stanford, California, 94305, U.S.A.

FOREWORD

by Martin Carnoy

For analytical purposes, job preparation is a four-stage process: informal education in the home environment, formal schooling, formal training (either inside or outside the employment system), and the acquisition of job knowledge and skills through work experience. One of the key issues in planning human resource development for economic growth is to determine how different kinds and alternative combinations of these elements affect worker productivity, and the extent to which it is possible to interchange education, training, and experience without sacrificing productivity levels.

In this study, which is concerned with the training of skilled workers, William Fuller measures the relative contributions of specific kinds of occupational training to the productivity of workers with different levels of formal schooling, controlling for differences in environmental background variables such as socio-economic status, urban-rural residence, religion, and caste. The study is based on information obtained from interviews with 600 skilled tradesmen in two factories in Bangalore. Fuller finds that there are significant differences in the productivity of workers with different kinds of training, but with similar levels of education and environmental backgrounds--workers who have had mainly informal in-plant training are the best producers. He also shows that workers who have had formal training in technical schools are promoted within skilled occupational categories more rapidly than workers with primarily in-plant training, suggesting that promotion is determined more by a certificate of qualification than by actual job performance.

The study makes a number of contributions to the literature in the field:

(1) It provides empirical evidence supporting the general notion that specific job training is most effectively given within the employment system.

(2) As a measure of productivity, Fuller has used an index of output based on time and motion studies of job tasks. This is a welcome departure from the traditional approach of using income, which may reflect many conditions besides productivity levels.

(3) The study also provides interesting information about the backgrounds of workers who are employed in skilled industrial work in South India. The data suggest that workers who grew up in rural areas are unusually gifted compared to their urban counterparts in the same occupation, as their productivity and educational attainment are generally higher.

In any study involving survey field work, the researcher is bound to run into unforeseen methodological problems. Fuller has candidly described some of these pitfalls. His experience may be useful to other researchers and may encourage the reporting of similar kinds of problems in future studies.

PREFACE

One of man's perennial concerns has been how best to prepare young persons for work. Traditionally, job knowledge and skills were acquired through experience in a place of work, usually by observing and imitating master craftsmen. With industrialization, and the appearance of new occupations, the alteration and disappearance of traditional ones, and massive increases in demand for skilled and higher level workers, more effective ways were needed to provide job know-how. Work experience declined as an avenue of skill acquisition, and schools, training institutes, and in-firm training schemes assumed a larger responsibility for occupational preparation. Today, in view of the vast amounts of resources that are being allocated to these schemes, it is not surprising that economists and educators are attempting to determine the content and locus of education and training that are most effective and efficient in preparing for specific occupational roles.

One approach to studying this issue is to select from a particular occupation a group of workers that has had different kinds of education, training and work experience, and relate these variables to worker productivity, holding constant other influences that affect productivity, such as physical capital, environmental conditions, and attitudinal characteristics. In every occupation there are some workers who consistently maintain higher levels of productivity than others--can variance in productivity within specific occupations be attributed to some extent to differences in education, training and experience? Do some kinds of education and training contribute more to worker productivity than others? Are there tradeoffs between education, training and experience in occupational preparation? What are the relative costs of different training schemes? These are some of the questions that are considered in this study of skilled workers in two factories in South India.

The study would not have materialized without the extensive cooperation of the staff of the Directorate General of Employment and Training in New Delhi and its office in Bangalore, and the two firms in which field research was carried out. I am indebted to the managers, supervisors, foremen and labor officials of the two companies for their understanding and support as the research was going forward. Special thanks must go to Mr. Richard H. Fuller, Miss H. E. Rego, Mr. K. Srinivasan, and Mr. T. S. Venkatakrishna for their help in interviewing workers.

Dr. Eugene Staley, formerly professor at the Stanford International Development Education Center and now Consultant on Occupational

Education with The Ford Foundation in India, provided valuable guidance during the study's design. Sri H. N. Pandit, of the Economics of Education Unit, National Council of Educational Research and Training, and Sri M. Matur, of the Institute of Applied Manpower Research, also generously contributed their ideas about the study's scope and methodology. I would also like to thank Dr. K. V. Sridharan, of the National Institute of Social Science in Bangalore, for his views regarding environmental influences on worker productivity.

At Stanford University, continuous support and encouragement were received from Professor Martin Carnoy and Dr. Frank J. Moore of SIDEC and Professor Koji Taira of the Department of Economics.

My largest debt, however, is to the 598 turners, millers, and grinders who cooperated fully in the interviews, thereby providing the information on which the study is based.

William P. Fuller

Stanford University
March 1970

TABLE OF CONTENTS

FOREWORD by Martin Carnoy v

PREFACE vii

LIST OF TABLES xi

CHAPTER

I INTRODUCTION 1

Some Problems of Recent Approaches in Evaluating the Economic Contribution of Education and Training 2
Purpose of the Study 5
Issues and Hypotheses 5
The Importance of Occupational Educational Research in India 8
Summary 9
Subsequent Chapters 9

II THE MODEL 11

Variables and Measures 12
The Data 19

III GENERAL CHARACTERISTICS OF WORKERS INTERVIEWED 21

Sex, Age and Job Experience 21
Finding a Job in MACH and ENG 22
Migration 22
Occupations of Fathers 25
Ethnicity 26
Family and Income 31

IV EDUCATION AND TRAINING 33

Education 33
Training 43

V PRODUCTIVITY AND ITS RELATIONSHIP TO EDUCATION, TRAINING AND EXPERIENCE 49

Education and Efficiency 50
Training and Efficiency 51
Experience and Efficiency 53
Historical Tradeoffs Between Education, Training, and Unskilled Experience 55
Productivity and Combinations of Education and Training 57
Comparative Training Costs 66

VI EDUCATION, TRAINING, RECRUITMENT AND PROMOTION 79

Recruitment 79
Promotion 80

VII CONCLUSIONS AND SOME IMPLICATIONS 87

Conclusions and Implications Relevant to Methodology 89
Conclusions and Implications Relevant to Theory, Research, and Practice 90

BIBLIOGRAPHY 95

APPENDICES

I A Worker Characteristic Rating Scale 103

II Questionnaire for Supervisors 104

III Interview Schedule for Workers 110

IV Castes and Subcastes, MACH Workers 122

V Percentage Distribution of How Jobs Were Found in MACH and ENG 123

VI Percentage Distribution of Workers by Relatives Living in Same House 124

VII Training Paths Represented Among MACH and ENG Workers 125

VIII The Relationship of Efficiency and Years of Education, Months of Training, Years of Trade Experience, and Other Variables 126

IX Relationship of Efficiency and Training Path and Other Variables 127

X Relationship of Efficiency and Training Path for MACH and ENG Workers with 0-8 Years of Education 128

XI Relationship of Efficiency and Training Path for MACH and ENG Workers with 9-11 Years of Education 129

XII Relationship of Efficiency and Training Path for Workers with 12 or More Years of Education 130

LIST OF TABLES

TABLE		
1	Previous Employment Data, MACH and ENG	23
2	Childhood Residence, MACH and ENG Workers	24
3	Occupations of Fathers, MACH and ENG Workers	25
4	Distribution of Workers by Religion, MACH and ENG Workers	27
5	Distribution of Hindu Workers by Caste Groups in Mysore	28
6	Distribution of Hindu Supervisors by Major Caste Groups in Mysore	30
7	Dependency Ratio and Family Size, MACH and ENG Workers .	31
8	Years of School Completed, MACH and ENG Workers	34
9	Distribution of Education Attainment (Years) by Age, MACH and ENG Workers	35
10	Reasons for Dropping Out of School, MACH and ENG Workers	36
11	Distribution of Pass and Fail at Secondary Levels by Residence	37
12	Education as a Function of a Number of Variables, MACH and ENG Workers	39
13	Distribution of Worker's Education by Father's Education	41
14	Years of Education by Caste, MACH Workers	42
15	Training Path by Caste, MACH Workers	45
16	Training Path by Father's Occupation, MACH Workers . . .	46
17	Training Paths by Education, MACH Workers	47
18	The Relationship of Education, Training and Experience to Efficiency, MACH and ENG Workers	50
19	The Relative Relationship of Training Paths to Efficiency, Holding Education, Experience and Environmental Variables Constant, MACH and ENG Workers	52

TABLE

20	Mean Efficiency by Paths, MACH and ENG Workers	52
21	The Stock of Education, Training, and Experience for Workers in Different Age Groups, MACH and ENG Workers	56
22	Index of Relative Percentage Point Additions of Paths 1, 2 and 3 to Efficiency for Workers with Low, Medium and High Education, MACH and ENG Workers	58
23	Means of Independent Variables for Different Efficiency Levels for MACH Workers with Path 1 and Path 2 Training and 9 to 11 Years of Education	60
24	Relation of Independent Variables to Efficiency for MACH Workers with Path 1 or Path 2 Training Who Have Had 9 to 11 Years of Education, MACH	62
25	Correlation Coefficients for Childhood Residence by Job Satisfaction and Job Aspirations	65
26	Present Value Costs per Trainee of Path 1 Training . . .	68
27	Total Operating Costs of MACH Training Center, 1968-69 .	70
28	Yearly Earnings for MACH Starting Skilled Worker	72
29	Net Present Value per Trainee Costs of Apprentice Training, MACH	73
30	Monthly Earnings of MACH Workers in Deployment Training	74
31	Comparative Costs of Training Paths, MACH	76
32	MACH Workers' View of Determinants of Promotion	81
33	Variables Related to Wage Grade Levels, MACH and ENG Workers	82

CHAPTER I

INTRODUCTION

The notion that productivity can be raised by investments in education and training has received increasing support in recent years from economists and educators. The relationship of education and training to economic growth has been a subject of intensive study, and although the precise nature and extent of that relationship continue to elude social scientists, research has established that it is a positive one.[1]

The rapid growth of research in this field has been facilitated by advances in data analysis, together with major improvements in techniques for processing large quantities of data. Yet despite these improvements there is a continuing need for reexamination and refinement of methods for estimating the contribution of education and training to income and productivity.

---

[1] See, for example, Edward F. Denison, "Measuring the Contribution of Education (and the Residual) to Economic Growth," The Residual Factor and Economic Growth (OECD Study Group in the Economics of Education, Paris, 1964); Frederick Harbison and Charles A. Myers, Education, Manpower, and Economic Growth (New York, 1964); T. W. Schultz, The Economic Value of Education (New York, 1963); John Vaizey, The Economics of Education (New York, 1962). For summaries of research, see C. Arnold Anderson and Mary Jean Bowman, eds., Education and Economic Development (Chicago, 1965); UNESCO, Readings in the Economics of Education (Paris, 1968).

POOR ORIGINAL COPY - BEST AVAILABLE AT TIME FILMED

Some Problems of Recent Approaches in Evaluating the Economic Contribution of Education and Training[1]

Too Broad a Focus. Research in the "economics of education" has encountered four general types of problems. Many studies have been concerned with macro analyses of aggregate national data, rather than with investigations of specific education and training projects in particular geographic regions. It is likely that several of these studies have estimated inaccurately the contribution of education to productivity by omitting important variables that can distort income or other productivity measures and dilute education's effect, such as government employment schemes or individual achievement motivations.[2] There is also the risk that macro analyses may obscure important regional variations, such as differences in socio-linguistic backgrounds, labor supply-demand relationships, and local mixtures of occupations.[3]

Too Narrow a Focus. Micro or case studies lessen the dangers inherent in macro analyses, but many times fall prey to the problem of focusing too narrowly. These studies usually evaluate a single education or training program, or compare alternative education or training schemes. These approaches may disregard the effects on productivity of combinations of education, training, and work experience. In attempting to maximize productivity by finding the right inputs of education and training, there are sound theoretical and empirical reasons for evaluating these elements in combinations rather than in isolation. Education, training, and experience are not only related but, as Becker, Mincer, and others have suggested, can be substituted

---

[1]A good assessment of methodological problems is presented in William G. Bowen's "Assessing the Economic Contribution of Education: An Appraisal of Alternative Approaches," Economic Aspects of Higher Education (OECD, Paris, 1964).

[2]See discussions in Martin Carnoy and Hans Thias, Cost-Benefit Analysis in Education: A Case Study of Kenya (IBRD, Washington, D. C., 1969).

[3]For example, unskilled workers normally have low mean incomes with little variance. Since means and variance increase with levels of skill and responsibility, the distribution of incomes of all occupations will be more dispersed and skewed than that of a single occupation; this will in turn affect calculations in cost-benefit analyses. See Harold Lydall, The Structure of Earnings (Oxford, 1968), p. 56.

for each other to some degree.[1] Several studies have confirmed this view.[2] If education, training, and experience are not mutually exclusive progressions in job preparation but are interrelated and are somewhat substitutable, it would be clearly misleading to examine each separately in planning job preparation with a view to maximizing worker productivity.

Problems of Methodology. Generally methods of evaluating education and training are of two kinds. One approach relates curriculum content to job tasks; the other examines returns (measured by income differentials) to education or training investments.[3] Both have weaknesses. The first may show whether curriculum is related to job performance, but it does not indicate which kinds of curricula or education and training schemes are most important for the achievement of high levels of productivity in certain occupations. The second approach shows which education or training schemes are related to higher incomes but does not tell us whether these schemes are directly relevant to job performance or related to productivity. Income is not necessarily a good indicator of productivity: it may reflect circumstances that are unrelated to productivity, such as seniority, union demands, favoritism, sex, and socioeconomic class.[4] Moreover, most training programs prepare persons for jobs at specific occupational

---

[1]Gary S. Becker, Human Capital: A Theoretical and Empirical Analysis, with Special Reference to Education (National Bureau of Economic Research, New York, 1964); Jacob Mincer, "On-the-job Training: Costs, Returns and Some Implications," Journal of Political Economy, Vol. LXX (Chicago, October, 1962), pp. 50-79.

[2]J. Maton, "Experience On-the-Job and Formal Training as Alternative Means of Skill Acquisition: An Empirical Study," International Labour Review, Vol. 100, No. 3 (Geneva, September, 1969), pp. 239-257.

[3]An interesting example of the first approach is Donald Maley's An Investigation and Development of the Cluster Concept as a Program in Vocational Education at the Secondary Level, Final Report Phase 1, and Course Outline for Electro-Mechanical Installation and Repair Cluster (University of Maryland, 1966). Also see M. U. Eninger, Process and Product of Trade and Industrial High School Level Vocational Education in the United States, Vols. I and II (Educational Systems Research Institute, Pittsburgh, Pa., 1968). Examples of the second approach are cost-benefit studies, a number of which are cited in the bibliography.

[4]Harold Lydall, The Structure of Earnings (Oxford, 1968), pp. 68-112.

levels, and it would be fruitless to employ income as a measure of productivity of workers in the same occupational and wage categories (obviously there would be little income variance, if any).

What is needed is a reliable measure of the relative output of workers. There are several possibilities. Where workers are producing identical items and are paid on a piece-rate basis, earnings would mirror productivity differences; or the number of completed pieces per hour could be counted. An alternative is some form of merit rating, but this measure is seriously weakened by a reliance on the subjective judgment of raters and is open to many biases.[1] A third option is incentive pay; however, the amount of incentive pay per extra unit of work accomplished is often calculated as a percentage of base earnings and therefore is influenced by wage grade (which may not reflect productivity). Moreover, incentive pay depends on the extent to which workers are occupied: if a company is not operating at capacity, some workers may get more jobs than others and therefore earn more incentive pay even though the other workers may be just as efficient and productive when they are working. A fourth possibility is the use of efficiency ratings based on standard (normal) times for job completion, which are estimated by time and motion studies.[2] There is, of course, room for error in time estimation, but if workers are performing similar tasks these errors would affect all workers equally.

Limited Attention to Training and Productivity. In addition to problems of approach and methodology, "economics of education" literature has suffered from the limited attention given to the relationship of training and worker productivity in specific occupations. A number of scholars have provided recommendations for the content of training, with a view to enhancing job performance, and others have considered the merits of training offered within the employment system compared to training given outside, in technical schools or institutes. But few empirical studies have been done that relate different kinds of training to actual levels of worker productivity. The findings of

---

[1]A recent study using foreman evaluations of workers is by Morris A. Horowitz and Irwin L. Herrnstadt, "The Training and Education of Tool and Die Makers," Proceedings of the Industrial Relations Research Association, Winter, 1967, pp. 15-24. Some of the risks in using ratings are pointed out by Claire Selltiz, Marie Jahoda, Morton Deutsch, and Stuart W. Cook, Research Methods in Social Relations (New York, 1951), pp. 255-268.

[2]Standard hours are divided by actual hours to derive efficiency percentages.

such studies could provide evidence suggesting the optimum content and locus of training for specific occupational roles.[1]

In summary, recent research has been characterized by an emphasis on aggregate data, the analysis of which may overlook variables that affect income and productivity; the narrow focus of micro studies that may avoid examining the effects of combinations of education, training and experience; the almost exclusive use of income as a measure of productivity; and inattention to the relationship of training to productivity in specific occupations.

Purpose of the Study

This study has tried to avoid some of these difficulties. Its purpose was to evaluate not only the separate effects of education, training, and experience, but also the effects of alternative combinations of these elements, on the productivity of workers in three skilled occupations (turning, milling, and grinding), controlling for age, seniority, general ability, socioeconomic class, childhood residence, job aspirations, job satisfaction, religion, caste, and number of family dependents. A second objective was to assess the costs of alternative trade training schemes. The companies selected were a public sector manufacturer of machinery (hereinafter referred to as MACH), and a private sector producer of engine parts (hereinafter referred to as ENG), in Bangalore, India.

Issues and Hypotheses

1. The association of combinations of education, training, and experience with productivity. Are certain combinations more highly

---

[1]This subject will be more fully elaborated in the following section of the paper. For a good summary of recent ideas about training, see Eugene Staley, Planning Occupational Education and Training for Development (SIDEC, School of Education, Stanford University, 1968). It is useful to distinguish between outside-employment training, where the trainee or his family are solely responsible for the choice of training and possibly some of its costs, and in-employment training, where an employer arranges for training and covers at least a part of its costs. See B. Fortin, "Education and Training Programmes," Human Resources for Industrial Development (ILO, Geneva, 1967).

associated with productivity than others? Because of the extensive use of shop mathematics and blueprint reading in turning, milling, and grinding, and the need to understand the practical, causal relationships between machines, coolants, and raw materials, it was hypothesized that the best workers would have a combination of at least some secondary education and practical in-employment training.

2. Years of education and productivity. Is secondary education a minimum prerequisite for skilled work in the metal cutting trades? Do workers with some secondary education perform less satisfactorily than those with a full secondary education? The hypothesis was that general education, since it is not directly job related, would be weakly but positively associated with worker productivity.

3. Training and productivity. It was hypothesized that there were many training paths preparing skilled Indian workers, but that workers who had in-employment training would perform better than workers who had outside-employment training.

Several writers have commented on the advantages of in-employment training.[1] Most seem to agree that the kinds and qualities of trade training offered in outside employment institutes and schools many times are not in tune with the skills needed by the employment system; that those trained in technical schools are often dropouts of other schools or academic failures who have fallen into vocational-technical training as a last resort and are not therefore highly motivated to learn; that in-employment training may involve production work that cannot be adequately duplicated by outside employment facilities; that the quality of in-employment training is superior because instructors are experienced production workers or supervisors, and tools and equipment are relevant and up-to-date (although it can be argued that experienced production workers or supervisors can be weak in pedagogy); and that trainees in in-employment schemes are more satisfied and committed to learning because they earn and learn at the same time.

In view of these and other problems, Staley proposes a four-phase scheme for occupational preparation.[2]

---

[1] Staley, op. cit., pp. 68-72.

[2] Ibid.

a. General education: during which elementary skills in communication and computation, as well as knowledge of the biological, physical, and social world would be provided.

b. General and pre-occupational education: during which increasing attention would be devoted to occupationally oriented subjects and practices, with the objective of producing trainable persons.

c. Job-entry training and further education: which would include specific occupational instruction, work experience, and continued occupational education.

d. Career-long retraining and further education: which would advance a worker's competence in dealing with his job, or renew his qualifications by updating his knowledge and skills, or prepare him for promotion or transfer.

Staley mentions that phases a and b normally would be the responsibility of the school system, but would be carried out with the cooperation of employing organization; phases c and d would generally take place in in-employment.

4. Recovering in-firm training costs. Irrespective of the possibilities of better quality in-employment training, Becker holds that specific job training designed to provide skills uniquely needed by a firm ought to be the financial responsibility of that firm, since it stands to recover its training investment by increases in worker productivity.[1] General training, involving the provision of widely transferable skills that are useful to many firms, would be left to the school system, since there is no assurance that a firm offering such training would recover its investment.[2] However, most in-firm training includes both specific and general elements, and there is always a risk that a firm may lose a trained employee before it has recovered its training investment. There are a number of way in which a company can minimize this risk. It could guarantee high wages for workers who were trained in the firm; however, there is still a chance that other firms would be willing to offer even higher wages, since they did not have to bear any of the training costs. Another approach

---

[1] Becker, op. cit.

[2] Ibid.

might be to make productive use of trainees during training (even if this means lengthening the period of training) and keep wages or stipends well below productivity levels. We hypothesized that this latter approach was being followed by firms that offered in-employment training.

5. Training and promotion. Another hypothesis was that outside-employment training would be more related to promotion than in-employment training. This may be because the qualifications needed for different positions are upgraded as the pool of unemployed educated and trained increases and consequently an undue emphasis is placed on outside-employment training certificates. Or it may reflect the better experience managers have had with skilled workers who have such training. It is conceivable that workers who have broad outside-employment training (in-employment training is more job specific) have widely applicable skills and knowledge that are needed in higher positions.

6. Tradeoffs--education, training, and experience. The hypothesis was that the overall level of education is increasing among workers, and that outside-employment training is replacing some years of unskilled experience as preparation for skilled work, since the general trend of Indian vocational-technical education is toward standardized mass training and away from the master-apprentice shemes that characterized traditional trade training.

7. Education, training, productivity, and worker backgrounds. The study explores other questions and issues. Is there a difference in productivity between workers educated in rural areas as opposed to urban areas? Is there any relationship between years of schooling or kind of training path followed and socioeconomic class, religion, caste, father's occupation and education, childhood residence, and number of elder brothers?

The Importance of Research in India

Our introduction would not be complete without a comment on the need for research in India that aims at identifying the most effective combinations of education and training for specific job preparation. It is possible that research of this kind may lead to education and training strategies that improve worker productivity. But also, more effective and occupationally oriented education and training may be one line of assault against a formidable enemy--unemployment, particularly "educated

unemployment." In 1967 it was estimated that half a million people with eleven years or more of schooling (or six to seven percent of the country's educated labor force) were out of work.[1] Estimates of secondary school output in coming decades coupled with manpower forecasts grimly portend that by 1986 India may have four million more secondary school graduates than it can employ.[2] It is hoped that this study will add to the work presently being done in India to evaluate current approaches to occupational preparation.

Summary

In brief, the study describes the relationship of worker productivity and education, training, and experience, and assesses the costs of alternative training paths. It also examines the relationship of background variables (such as socioeconomic status, religion, caste, and childhood residence) and worker productivity, educational attainment, and kind of training received.

Subsequent Chapters

Chapter II presents an analytical model and defines the variables. Chapter III describes the general characteristics of the work forces of both firms, including age, experience, how jobs were located, occupations and educations of fathers, ethnicity, and family size and income. Chapter IV summarizes education and training characteristics, and examines the effects of different background variables on educational attainment and kind of training. Chapter V analyzes the effects of combinations of education and training on worker productivity, and the costs of training, and Chapter VI looks at the relationship of worker productivity and promotion. Chapter VII summarizes the study's findings and suggests some implications for research and policy.

---

[1]Mark Blaug, P. R. G. Layard, and M. Woodhall, The Causes of Educated Unemployment in India (Unit for Economic and Statistical Studies on Higher Education, Indian Statistical Institute, Delhi, 1967).

[2]Tyrell Burgess, Richard Layard, and Pitambar Pant, Manpower and Educational Development in India (1961-1986) (Oxford, 1968), p. 55.

CHAPTER II

THE MODEL

It is proposed that five categories of independent variables --general education, trade training, work experience, environmental characteristics,[1] and general ability--influence worker productivity, holding constant physical capital. It is further proposed that there are interrelationships between the independent variables, for example, the social-economic environment may be a significant determinant of who gets how much and what kinds of education and training, or general ability may affect the degree of benefit derived from education and training.

The relationships and interrelationships of these variables were estimated by computing a regression equation, treating productivity (measured by worker efficiency) as a function of education, training, experience, age, socioeconomic class, religion, caste, childhood residence, job aspirations, job satisfaction, and number of dependent family members.[2] As there was no proven theoretical reason for selecting a particular shape of curve for these relationships, it was assumed that it was linear.[3]

$$Y_t = a + b_1x_1 + b_2x_2 \ldots\ldots\ldots b_nx_n + u,$$

where Y_t is worker efficiency at a given point in time, x_1 to x_n the independent variables, b_1 to b_n the coefficients expressing the strength of relationship between Y_t and x_1 to x_n, a the point of intercept, and u the error term. Religion, caste, and childhood

---

[1]Variables in this category include socioeconomic status, religion, caste, childhood residence, family dependents.

[2]General ability--based on trade test scores--was later dropped from the equation because there was little variance in scores and its relationship to productivity was small and statistically insignificant.

[3]Other curves were tried, for example, log and exponential curves, but these did not improve our estimates.

residence were broken down into dummy variables representing different kinds of each variable.[1] These variables took a value of 1 whenever the worker fell into that category and a 0 when he did not. All other variables were measured by a continuous scale.

In another set of equations, education was treated as a parameter; that is, the populations of the two factories were divided into groups representing different years of schooling. Worker productivity was then estimated as a function of training, trade experience, and environmental variables. By this approach, the association of combinations of education, training, and experience with productivity could be seen, and the interaction of education and other variables studied.

Other equations included years of education as a function of father's occupation, father's education, number of older brothers in the family, religion, caste, childhood residence; and promotion as a function of efficiency, seniority, trade experience, age, job aspirations, job satisfaction, socioeconomic class, caste, religion, education, and training paths.[2]

The use of regression equations served two main purposes: to test the strength of the relationship of each independent variable with the dependent variable holding constant other variables at their means; to test the significance of these relationships.

Variables and Measures

Worker Productivity. Worker productivity is defined as the amount of goods and services produced by a worker during a specified period of time and is measured by 1968 efficiency ratings in both

---

[1]Religion: Hindu, Muslim, Catholic, Protestant, Jain.
Caste: Brahmin, Kshatriya, Vaisya, Sudra, Scheduled.
Childhood residence: farm village, district town, main city.

[2]It was recognized that there might be problems of multicolinearity; that is, when two or more "independent" variables are linearly related and this relationship affects their coefficients. To avoid this problem we parameterized the population of workers by training, education, and religion, or simply left out variables that were expected to be strongly related to other independent variables.

firms.[1] This measure is computed by dividing standard hours (normal times estimated for job completion) by actual hours of work. The advantages of using efficiency as a measure are that it is directly job-related, and that it holds constant factors affecting productivity that are extraneous to the worker, such as machine capacity, availability of tools and instruments, and hardness of raw materials, thereby enabling us to concentrate exclusively on the worker's individual effort.

To test the reliability of this measure, ratings were taken for three different years and correlated. The lowest correlation was .73.[2] Time standards are subject to error, but these are probably random and compensated for by our population size, or if not, affect all workers equally. If this were not the case, we probably would have found substantial differences among trades or between tool room and production workers in efficiency means and variance.

As another measure of worker performance, a merit rating form encompassing 14 characteristics, including efficiency, was completed by supervisors for all workers interviewed.[3] This measure was later rejected as invalid and unreliable. Despite pretests and briefings, there were considerable differences in the shape of the distributions of scores given by different supervisors. However, the most disheartening evidence was that supervisor ratings of worker efficiency correlated only .5 with actual efficiency data. There was little reason to think that the judgments of supervisors on other worker characteristics would be any more valid. This outcome probably reflects the fact that each supervisor had a somewhat different set of criteria or frame of reference for evaluating workers. Our experience may serve as a warning to other researchers who contemplate using rating scales as a measure of job performance without having any harder measures against which to test their validity.

---

[1] R. W. Fenske, "An Analysis of the Meaning of Productivity," Productivity Measurement Review (OEEC, Paris, August, 1965).

[2] Normally there would not be a perfect correlation between efficiency ratings at two time points because some older workers will be declining in efficiency as a result of deteriorating physical and mental fitness and newly recruited workers will presumably be increasing their efficiency levels for the first months at a faster rate than average workers.

[3] See Appendix I.

Education and Training. Education is defined as the provision of skills and knowledge and the inculcation of attitudes generally relevant to a number of roles in society, the economy, and the polity; training refers to the provision of knowledge, skills, and attitudes required for "adequate performance of a task or a set of tasks that together comprise a job."[1] Education (which is not specifically job-related) is normally provided in outside employment institutions, whereas training may be given either within or without the employment system. Education is measured by years of schooling, by success or failure, and by whether it was given in urban or rural areas. Training is measured by months, by kinds, and by whether it was given inside or outside the employment system.

At the research location, the education system included four to five years of primary school, three years of middle school, three years of high school, one year of pre-university, and varying years of university. Popular outside-employment training schemes were the Industrial Training Institutes (ITI),[2] a one-and-a-half-year trade course for boys who have had some secondary schooling; and Polytechnics, a three-year engineering course for secondary school graduates. In-employment training consisted of full apprentice training, a three-year in-firm training program for secondary graduates; artisan craftsmen training, a one-year program of in-firm training for ITI graduates; learner training, any organized in-firm training scheme that is not covered by the Indian Apprentices Act of 1961; refresher training, in-firm upgrading or renewal of skills; and "picking-up the trade," cases in which workers have had no organized training but have acquired their trade by observing and imitating co-workers and supervisors.[3] With the exception of "picking-up the trade," each of the other in-employment categories included periods in the firm's training center for theoretical instruction and practice in using machinery and tools, or supervised on-the-job training, or both. On-the-job training is defined as supervised shop training that is designed by the company even though there may be no scheduled content or predetermined length.[4]

---

[1] Staley, op. cit., pp. 7-8.

[2] This course was extended to two years, but all workers in the factories who had taken ITI training had participated in the 18-month course.

[3] Horowitz and Herrnstadt, op. cit., pp. 17-18.

[4] Ibid.

Experience. Work experience is an extremely important means of learning. It is impossible for outside and in-employment programs to prepare trainees for all conceivable tasks they may encounter; clearly, specific job knowledge and skills can be refined only through practical experience. Experience is measured by the number of years the worker has spent in the trade. There is, however, a risk in using years as a measure; it is by no means uncommon to meet a person who has spent years in the same job and has learned little from it. Whether experience is a useful instrument for developing skills, knowledge, and attitudes depends on each worker's individual abilities, willingness to experiment with new techniques, previous education and training, and so on. Therefore, we expected to find a less clear relationship between experience and productivity than between education or training and productivity.

Socioeconomic Status. Socioeconomic status (SES) in India is determined not only by such factors as father's occupation and education but also, particularly in rural areas, by religion and, among Hindus, by caste.[1] Rather than develop an arbitrary index that would include all these ingredients, it was decided to treat religion and caste as separate variables and to group father's education and occupation into a single variable called SES, thus making clear the unique association of religion and caste and SES with worker productivity and other variables.[2]

To prepare an SES index, father's occupations were divided into six categories similar to those used by Hollingshead, and were given a value of 1 to 6.[3] These categories were: farmers, foresters, and miners; unskilled factory or workshop employees; skilled manual employees, clerical and sales workers, low government officials, technicians, and owners of small businesses; teachers, instructors, and high government officials; major professionals. Years of father's education were divided into the following categories and assigned values of 1 to 5:

---

[1]See George Rosen's discussion of caste and class in Chapter 2 of his Democracy and Economic Change in India (The Rand Corporation, Los Angeles, 1966).

[2]It would be difficult to assign a proper weight to the contribution of caste to socioeconomic status, since the importance of caste varies, for example, according to geographic region. This issue is discussed in Rosen, op. cit.

[3]August B. Hollingshead, Two Factor Index of Social Position (New Haven, Conn., 1957).

no education, 2-4 years, 5-9 years, 10-12 years, 13-19 years. An SES scale was formed by adding the values of father's occupation and education. The distribution of the scale was slightly skewed to the right.

Religion and Caste. Five religions were represented: Hindu, Muslim, Catholic, Protestant, and Jain. Because of the large number of sub-castes represented, it was necessary to group them into main castes for statistical analysis. This posed certain problems: many workers did not know their main caste, and the position of sub-castes often varies from state to state or even within states. Consequently, the inclusion of sub-castes within main castes was prepared on the basis of the expert judgment of the staff of the National Institute of Social Science in Bangalore.[1]

Childhood Residence. Our primary interest was whether workers spent their childhood years in a farm village, in a district town, or in a main city. It was assumed that place of residence during primary schooling would serve as a good indicator of the environment in which the worker grew up.

Dependent Family Members. It was thought the strong sense of family obligation and duty that is pervasive in India might affect worker productivity in one of two ways: on the one hand, because worker income is usually contributed to general family welfare, workers with large families might be expected to be less motivated to work hard to earn incentive pay, since their individual rewards would be greatly diluted.[2] On the other hand, workers with large numbers of dependents might be expected to work harder for incentive pay because they had more mouths to feed. The following calculation was used to compute the number of household family members dependent on the worker's earnings:

$$\text{Dependents} = \frac{\text{worker earnings}}{\text{family income}} \times \text{total family size}$$

---

[1] A list of main castes and sub-castes appears in Appendix IV.

[2] K. Sreenivasan, Productivity and Social Environment (Bombay, India, 1964), pp. 37-90.

Job Aspirations. In this category, workers were asked what position they thought they could reach in the company before retirement, provided the company did well and there were normal opportunities for advancement. Since most workers were some years away from retirement (15-20 years), present wage grades were not expected to have much influence on what the worker felt would be the highest position he could attain. This was later confirmed: the differences in mean aspirations among workers in various grades were very slight. In MACH the hierarchy included four categories of skilled workers, two assistant supervisory categories, supervisors, foremen, and the shop managers; in ENG there were four categories of skilled workers, assistant supervisors, supervisors, junior foremen, and shop superintendents. These were given numerical values beginning with 1.

Job Satisfaction. Initially a Likert scale was used to probe worker attitudes in the following areas: relationship with supervisors, technical competence of the supervisory staff, abilities of co-workers, trust in management, working conditions, wages, and challenges offered by the job.[1] Questions were prepared following a review of similar questions used by other researchers and a series of pretests. It was found, however, that workers were reluctant to take extreme positions, so eventually the scale was collapsed to three positions--generally agree, undecided, and generally disagree. Because there was little variance in responses pertaining to the technical ability of supervisors and trust in management, these categories were dropped from the index. A composite scale score was computed by adding the scores of the remaining dimensions.

General Ability. General ability, defined as "an innate, general cognitive ability," may make a unique contribution to income and productivity.[2] Recent studies suggest that ability may have an effect on earnings, particularly with respect to workers with high levels of

---

[1]Respondents were asked whether they strongly agreed, agreed, were undecided, disagreed, or strongly disagreed with statements concerning these dimensions. The questions asked are found in the interview schedule that forms Appendix III.

[2]A definition by C. Burt, "The Evidence for the Concept of Intelligence," British Journal of Education Psychology, 1955, cited in Lydall, op. cit., pp. 71-72.

education.[1] Both Dennison and Becker suggest downward adjustments in weights given to education as a contributor to income, on the ground that ability may exaggerate education's real contribution.[2]

There are a number of conceptual and methodological barriers preventing clear analysis of ability and productivity.[3] One problem is the interaction between education-training and ability: ability partly determines the benefit to be derived from education-training, and education-training enhances ability. Unfortunately, we did not have any before-and-after education-training ability tests that would permit us to measure the effects and extent of this interaction, and its impact on productivity. One approach would be to use a general indicator of ability, such as an intelligence test score, and hold this variable constant while measuring the effect of different combinations of education and training on productivity. However, standardized aptitude and intelligence tests were not considered reliable measures of general ability in view of the vast range of linguistic groups, religions, castes, socioeconomic statuses, regional peculiarities, and education systems in India. For that reason, this study does not attempt to explain how general ability is affected by education or other social or economic influences, or how it affects workers productivity. It does, however, examine how differences in trade ability were related to productivity levels within a specific occupational category, recognizing that trade ability is the product of education, training, and other influences, as well as an innate general ability. Many MACH workers had taken a trade test on entering the firm, and scores on these tests were assumed to reflect trade ability differences prior to on-the-job experience.

---

[1] Zvi Griliches, "Notes on the Role of Education in Production Functions and Growth Accounting," paper prepared for the Conference on Research on Income and Wealth, November 15-16, 1968 (National Bureau of Economic Research, Inc., New York, 1968), p. 39.

[2] Dennison, op. cit.; and Becker, op. cit.

[3] A summary of some of these problems is presented in Zvi Griliches, op. cit.

The Data

Data were collected from interviews with 598 turners, millers, and grinders--514 from the production division and the tool room of MACH, and 84 from the tool room of ENG. An attempt was made to interview all workers in these sections.[1] Workers were interviewed on company time at MACH and at the shift end at ENG, each interview lasting 30-40 minutes.

MACH and ENG were selected for several reasons: they were reported to be representative of modern management and production practices in Indian industry; they were large employers of skilled tradesmen and maintained in-employment training facilities; they represented the public and private sectors; and they used efficiency ratings to measure the performance of workers.

Turning, milling, and grinding trades were chosen for study because they were jobs in which workers' knowledge and skills clearly contributed to productivity (mathematics, blueprint reading, workshop science, trade theory, and manual dexterity); they were among the most popular skilled trades in the country; and job tasks were sufficiently well defined so that time and motion studies were probably relatively accurate.

Standardized interviews were used to collect information on education, training, family composition and size, language, caste, age, migration, previous work experience, job aspirations, job satisfaction, and education and occupation of fathers and brothers, as well as views on training schemes, incentive systems, and promotion.[2] The schedule was tested on ten workers and revised before being standardized. Questions were basically the same for both plants (although a few additional questions on time standards were included in the ENG questionnaire at the company's request). English, Kannada, Tamil, Urdu, and Hindi were used, depending on the language in which the worker felt most comfortable. Interviews were carried out by the researcher or, when local languages were required, by two assistants, who were briefed about interviewing techniques; most of these were made in the presence of the researcher.

In addition to interview data, company personnel records were examined to gather information on wages, promotion, jobs held in the

---

[1] Only four refused.

[2] See Appendix III.

company, disciplinary action, and attendance.

A second interview schedule was prepared for the supervisors of the turners, millers, and grinders interviewed.[1] At MACH 41 supervisors were interviewed; at ENG, three. The objective here was to determine the education, training, and work experience of the supervisors as well as other pertinent socioeconomic data, and to obtain their opinions about training paths for skilled workers. Since all supervisors were fluent in English, interviews were conducted by the researcher; they lasted about 20 minutes each.

---

[1]See Appendix II.

CHAPTER III

GENERAL CHARACTERISTICS OF WORKERS INTERVIEWED[1]

This chapter presents certain background characteristics of the workers interviewed in MACH and ENG. The relationship of many of these characteristics to educational attainment, choice of training path, and worker productivity will be considered in following chapters. It is appropriate to begin this chapter with a warning. It is important to bear in mind that the distribution of characteristics of the two work forces may not approximate the distribution of these characteristics for the population of India or Mysore generally, or even for smaller groups based on, for example, education or place of residence. Therefore, one must exercise caution in drawing inferences applicable to wider populations. For example, the finding that workers with rural backgrounds have more education than workers from urban centers cannot be generalized to rural populations or to any population other than urban skilled industrial workers in south India, for it is possible that only the most highly educated rural dwellers (whose educational characteristics would be unusual by rural standards) migrate to urban areas and find industrial jobs.

Sex, Age, and Job Experience

All workers interviewed were male with a median age of approximately 32 years. The average worker in MACH and ENG had almost ten years of trade experience and had been employed in his present firm for slightly over eight years.

MACH was the first job for 40.5 percent of interviewees, whereas ENG was the first for only 22.6. One reason for this difference could be MACH's surge of expansion in the late 1950's and early 1960's, a

---

[1]Education and training characteristics will be discussed in Chapter IV.

growth that required the recruitment of large numbers of workers, some of them necessarily very young and inexperienced because of a scarcity of skilled labor. ENG, in contrast, has exhibited a more orderly growth pattern and presumably has not been forced to recruit from among the inexperienced to the same extent. Moreover, ENG traditionally has offered higher salaries than MACH in Bangalore and probably has been in a better position to draw experienced workers away from other firms. Table 1 provides a summary of previous employment data for workers in both firms.

Not only was a larger percentage of workers in ENG previously employed, but a greater proportion of those with previous experience in ENG had held more jobs than had previously employed MACH workers. In both plants it appeared that previous work experience was connected mainly with metal cutting work.

Finding a Job in MACH and ENG

There were marked differences in the ways jobs were found in MACH and ENG. Of MACH respondents, 51 percent found employment through company placed newspaper advertisements or with the help of the staff of an ITI (31 percent). In ENG, recruitment procedures were less formal: 45 percent of the workers located their jobs through friends or relatives working in the company. Neither the state employment exchanges nor the unions were important avenues for locating employment in either firm.[1]

Migration

Over 70 percent of the workers in MACH and ENG were born in Mysore. However, only 43.5 percent in MACH and 58.3 percent in ENG claimed Bangalore as their place of origin. Most workers born outside Mysore were natives of Madras. Table 2 presents the type of environment (farm village, district town, or main city) where the workers spent their childhood years.

Both firms had about the same proportion of workers from farm villages, but ENG had a substantially higher percentage of workers from main cities.

---

[1]Appendix V provides a summary of ways in which jobs were found.

TABLE 1

PREVIOUS EMPLOYMENT DATA, MACH AND ENG

Number of Jobs Held before Present Job	Percent of Workers	Mean Years in Previous Jobs	Percentage of Workers Engaged in Factory or Workshop Metal Cutting Work (skilled or unskilled)
MACH:			
1 only	34.8%	2.8	84.0%
2 only	16.1	3.1	91.5
3 only	6.1	2.9	89.0
4 or more	2.5	..	..
	59.5%		
ENG:			
1 only	23.8%	3.1	81.5%
2 only	28.6	2.7	86.0
3 only	8.3	3.3	96.0
4 or more	16.7	..	100.0
	77.4%		

TABLE 2

CHILDHOOD RESIDENCE, MACH AND ENG WORKERS

	FARM VILLAGE		DISTRICT TOWN		MAIN CITY	
Company	Number	Percentage	Number	Percentage	Number	Percentage
MACH	118	23.0%	141	27.3%	255	49.7%
ENG	14	16.7	12	14.3	58	69.0

Occupations of Fathers

Table 3 summarizes the occupational categories of the workers' fathers.

TABLE 3

OCCUPATIONS OF FATHERS, MACH AND ENG WORKERS[1]

Occupation	MACH		ENG	
	Number	Percentage	Number	Percentage
Farmer, forester, miner	167	33.4%	15	18.1%
Unskilled factory or workshop worker	88	17.6	14	16.9
Skilled factory or workshop worker	100	20.0	26	31.3
Clerk, salesman, store operator	81	16.2	13	15.7
Building contractor	11	2.2	4	4.8
Teacher, instructor	23	4.6	4	4.8
Professional	9	1.8	2	2.4
Other	21	4.2	5	6.0
Total	500	100 %	83	100 %

[1] Workers were asked to indicate what the main occupation of their fathers was irrespective of whether fathers were presently working, unemployed, retired, or dead.

Because of the large number of workers in MACH with a rural origin, it was not surprising to find a larger percentage of fathers of MACH workers engaged in agriculture and mining, and a large percentage of ENG workers with fathers in skilled factory or workshop jobs. In ENG, 8.5 percent of the fathers were in the same trades as their sons, compared with only 4.2 percent in MACH.

It was evident that MACH had a much larger share of first generation workers than ENG. This might be explained in part by MACH's location in what had formerly been an agricultural area on the outskirts of Bangalore and the company's policy of attempting to absorb as many working-age persons as possible who were living in that area. Also it could be that ENG's recruitment favored second or higher generation workers, possibly because these workers performed more satisfactorily.

There were marked differences between MACH and ENG in the educational attainment of workers' fathers. In MACH, 36.5 percent of the fathers of workers had had no education, compared to 29.8 percent in ENG. Among those with some education, the mean years of schooling were 8.25 in ENG and 7.3 in MACH.

Ethnicity

Table 4 illustrates the strong representation of Hindus in both firms and the relatively large proportion of Catholics in ENG. The difference in the proportion of Hindus in MACH and ENG is striking but the data do not offer an explanation.[1]

---

[1] It was rumored at MACH that a previous personnel manager strongly favored the recruitment of Hindu workers from the Vokkaliga sub-caste (traditionally an agricultural sub-caste); his policy may partly account for the much larger proportion of Hindus in MACH compared to ENG.

TABLE 4

DISTRIBUTION OF WORKERS BY RELIGION, MACH AND ENG WORKERS
(Percent)

Company	Hindu	Muslim	Catholic	Protestant	Other
MACH	83.5%	7.0%	5.4%	2.9%	1.2%
ENG	66.3	10.8	19.3	3.6	0.0

Of 429 Hindus in MACH, 381 reported their castes. Major castes and scheduled castes were represented as follows:

TABLE 5

DISTRIBUTION OF HINDU WORKERS BY MAJOR CASTE GROUPS IN MYSORE

Caste	Number of Workers	Percentage
Brahmin	69	18.1%
Lingayat	27	7.2
Kshatriya	28	7.4
Vaisya	7	1.8
Sudra	216	56.7
Scheduled[1]	34	8.8
Total	381	100.0%

[1]It is possible that a large percentage of the 48 Hindu workers who did not specify their caste were from scheduled castes.

Within the clearly predominant Sudra caste, the traditionally agricultural sub-castes, such as Vokkaliga, Gowda, and Reddy, were strongly represented. It is interesting to note both the relatively large number of high-caste Brahmin workers and the rather small number of Vaisya, the commercial caste that one might suspect would take easily to factory work. Certainly the stereotype image of the Brahmin as unwilling to take up manual factory work is not supported by our data. Probably the main reason MACH has been able to recruit from high and low castes for similar positions is an economic one: skilled work is simply far more lucrative than many other types of work, for example, some kinds of menial and clerical jobs. In the factory's earlier years relatively more Brahmins were recruited than recently. From the data it is difficult to tell whether this situation obtains because Brahmins today are finding other, more satisfying occupations, or because the status of Brahmins has been downgraded and other castes are being favored for employment.

At the supervisory level, Brahmins clearly have the largest representation. Table 6 gives the caste affiliation of the supervisors of the MACH workers interviewed. Of 41 supervisors, two were Muslim, four Christian, and 35 Hindu.

Of the skilled working force interviewed, 18.1 percent were Brahmins and 56 percent Sudras, whereas at the supervisory level the number of Sudras diminished to 34.3 percent and that of Brahmins increased to 40.0 percent. Although the data do not suggest definitely why Brahmins are more strongly represented at the supervisory level, this might be attributed to their higher levels of education and outside-employment training, which are considered prerequisites for supervisory positions. Schedule caste workers have not reached supervisory positions and their representation among production workers is still somewhat below the figure given for their representation in south India--about 12 percent.[1]

It might be inferred, then, that caste has some relationship with upward occupational mobility at higher levels of factory organization, but in middle levels, such as among production workers, this relationship is weaker.[2] This finding concurs with Lambert's study of Poona industry.

---

[1]Rosen, op. cit., p. 28. His information is based on a sample survey conducted in 1952-1954.

[2]Richard Lambert, Workers, Factories and Social Change in India (Princeton, New Jersey, 1963), pp. 161-162.

TABLE 6

DISTRIBUTION OF HINDU SUPERVISORS BY MAJOR CASTE GROUPS IN MYSORE

Caste	Number	Percentage
Brahmin	14	40.0%
Lingayat	4	11.4
Kshatriya	1	2.9
Vaisya	2	5.7
Sudra	12	34.3
Scheduled	0	0.0
Other	2	5.7
Total	35	100.0%

Family and Income

The mean household size for MACH and ENG workers was about 6.5. A few families included wage earners other than the worker, usually a father or brothers--32.5 percent in MACH and 27.4 percent in ENG. In rare instances, mothers or wives were also wage earners. Other sources of household income included money returns on land, buildings, or other businesses, or receipt of agricultural products, but there were only a few cases: in ENG business returns or rent accrued to 4.8 percent of households, averaging Rs. 145 per household per month; in MACH, 2.9 percent of the households received outside cash income, averaging Rs. 210 per month. Agricultural produce was received by 3.7 percent of MACH households and 1.2 percent of ENG households. A small percentage of families sent money to relatives living elsewhere--3.8 percent in MACH and 3.6 percent in ENG.

Generally, however, the worker's earnings were by far the largest source of funds for family livelihood, as illustrated by Table 7, which compares the average number of family members supported by the worker and mean family size.

TABLE 7

DEPENDENCY RATIO AND FAMILY SIZE,
MACH AND ENG WORKERS

Mean Figures	MACH	ENG
Dependency Ratio	5.37	5.51
Family Size	6.7	6.45

There was a wide range of per capita income among worker families in both plants--Rs. 17 per month to Rs. 330 in MACH, and Rs. 31.8 to Rs. 312.25 in ENG (means were Rs. 75 and Rs. 82.7, respectively). It was suspected that per capita income distribution would be narrowly distributed and skewed to the right, which would have provided a clue about the amount of per capita income that might pose a limit on household size. However, with such a wide

range of income, and with a distribution only slightly skewed, it was impossible to tell what that point might be.

In summary, the average worker was in his early thirties and had been in his present trade for about ten years. Most workers had grown up in Bangalore, but a sizeable percentage had migrated from farming areas. There was a wide range of occupations of fathers: the two that appeared most frequently were farmer and skilled factory or workshop employee. In both firms Hindus were in the majority, with Sudra the most strongly represented caste (in MACH). The earnings of the workers were the most substantial contribution to the family's livelihood, a worker on the average supporting more than five family members.

CHAPTER IV

EDUCATION AND TRAINING

Education

In the states of Mysore and Madras, where most interviewees had received their general education, the public education systems for the most part were structured as follows: four-five years of primary school, three years of middle school, three years of high school, one year of pre-university, and varying years of university education depending on the field of study and degree desired.[1]

Years of Education. It was surprising to find that the average worker in MACH and ENG has almost the equivalent of a secondary education. The mean years of education are 9.8 in ENG and 10.2 in MACH. Table 8 shows the distribution of workers by number of school years completed.

The difference between the work forces at MACH and ENG in the attainment of full secondary education (ten or eleven years and beyond) is interesting. Of the MACH workers, 75.6 percent have ten or more years, compared to only 63.2 percent in ENG. It might be supposed that ENG would have had better educated workers, since the company in general offers higher salaries and so can presumably attract the cream of educated labor. One reason for this difference might be that MACH has emphasized the hiring of ITI certificate holders (who generally have finished secondary school), whereas ENG has not. Another might be that ENG has found through experience that less educated workers are just as productive as workers with a few more years of education, and that the less educated workers demand smaller wages. Speculation on this issue raises one of the main questions to be considered later in this study--whether years of general education are associated with differences in worker productivity.

---

[1]Government of India, Ministry of Education, Report of the Education Commission (1964-1966), Education and National Development (New Delhi, 1966), p. 26.

TABLE 8

YEARS OF SCHOOL COMPLETED, MACH AND ENG WORKERS

Years	MACH			ENG		
	Number of Workers	Percent	Cumulative	Number of Workers	Percent	Cumulative
0	2	0.4%	0.4%	2	2.4%	2.4%
4	13	2.6	3.0	0	0.0	2.4
5	10	1.9	4.9	1	1.2	3.6
6	10	1.9	6.8	3	3.5	7.1
7	14	2.7	9.5	6	7.1	14.2
8	43	8.5	18.0	13	15.5	29.7
9	33	6.4	24.4	6	7.1	36.8
10	61	11.8	36.2	10	13.1	49.9
11	270	52.5	88.7	23	27.4	77.3
12	40	7.8	96.5	12	14.3	91.6
13 and above	18	3.5	100.0	7	8.4	100.0
Total	514	100.0%	100.0%	84	100.0%	100.0%

Leaving School. Table 8 suggests that the most popular time to drop out of school is upon completion of the eighth and eleventh years--after middle school and after high school. It is likely, however, that the level of education is increasing, for the younger generation of workers has had more education than the older men, as Table 9 shows.

TABLE 9

DISTRIBUTION OF EDUCATIONAL ATTAINMENT (YEARS) BY AGE, MACH AND ENG WORKERS

Age of Workers	MACH[a] Number of Workers	MACH Percent 0-8 yrs.	MACH Percent 9-11 yrs.	MACH Percent 12 and over	ENG[b] Number of Workers	ENG Percent 0-8 yrs.	ENG Percent 9-11 yrs.	ENG Percent 12 and over
18-25	22	0.0%	90.9%	9.1%	10	0.0%	40.0%	60.0%
26-30	199	12.6	77.3	10.1	27	18.5	48.2	33.3
31-35	209	16.7	70.4	12.9	19	42.1	52.6	5.3
36 and above	84	38.1	51.2	10.7	28	42.9	46.4	10.7

a $x^2 = 34.33$, df = 6, $P < .001$
contingency coefficient = .25.

b $x^2 = 18.77$, df = 6, $P < .005$
contingency coefficient = .43.

There are several possible reasons for the rise in the stock of education in the turning, milling, and grinding trades among the younger generation. Perhaps employers think that education markedly increases efficiency (we shall see later that it does not). Or it may be because the period of waiting for a job after leaving school at any level has increased sizeably in the last decade. The Directorate of Employment in Bangalore reports that the waiting period has jumped to three to five years for boys who leave from the eighth through the eleventh year of

school.[1] In previous years a secondary school student may have reasoned that he was forgoing full-time employment and earnings by attending school; today he can expect to earn virtually nothing for two or three years if he drops out (although some casual employment still exists). Moreover, it is clear from the hiring policies of MACH and ENG that required educational qualifications for many occupations is on the rise as the pool of educated unemployed increases. This in turn provides further stimulus for boys to accumulate more education in order to compete successfully for the limited number of job openings. Finally, many of the Government-sponsored training programs, such as the ITI and apprentice schemes, require a secondary education as a prerequisite for admission.

Table 10 sheds some light on why boys dropped out of school.

TABLE 10

REASONS FOR DROPPING OUT OF SCHOOL, MACH AND ENG WORKERS

Level	Failed	Nonacademic Reasons
Primary School	17.5%	82.5%
Middle School	43.5	56.5
High School	51.5	48.5
Pre-University	58.0	42.0
University	100.0	0.0

---

[1]Government of Mysore, The Directorate of Employment and Training, Bangalore, Employment Review, Mysore State, April-June, 1968 (Bangalore, 1968). The District Employment Officer, Bangalore, reports that the waiting period is steadily increasing. The figures given here are somewhat inflated because some boys who find jobs probably do not notify the Employment Exchange and consequently remain on the waiting list. Moreover, there are surely many boys who find jobs but who have never registered with the Employment Exchange. Nevertheless, a waiting period of about three years is considered a fair estimate by persons concerned with employment problems in Bangalore.

Plainly, failure increases as a primary cause of academic departure as the student ascends the school ladder. One explanation may be that the benefits of education are not as clearly perceived by parents in earlier years as they are by students in later years. Another may be that difficulties encountered in adjusting to the newness and strangeness of the school system during the first years of schooling may discourage children. There are, of course, many other factors that contribute to the dropout problem, such as malnutrition and poor health, distance from schools, lack of books, poor teaching techniques, the necessity of working to contribute to family income, and so forth. The point is that in later school years the perceived benefits of education may be strong enough to compensate for such conditions.

In both factories proportionately more workers with rural origins passed high school than town students, who in turn were more successful than city students. These results are statistically significant. Table 11 takes into account only MACH workers, but a similar trend occurs in ENG.

TABLE 11

DISTRIBUTION OF PASS AND FAIL AT SECONDARY LEVELS BY RESIDENCE, MACH WORKERS[a]

Pass-Fail	Village (21)	Town (179)	City (223)
Passed high school	66.7%	56.4%	45.3%
Failed or discontinued high school	33.3	43.6	54.7

[a] $x^2 = 7.08$, df = 2, $P < .03$, C = .21.

Although the data do not point to specific causes of the relatively better performance in rural secondary school among MACH and ENG workers, a number of reasons are conceivable. One might be that industrial workers with rural backgrounds are exceptionally competent. As boys who were able to pass through the rigors of rural primary and middle schools, they might have been exceptionally determined and durable school attenders compared to their town and city counterparts. A larger proportion of students may drop out or fail in rural primary schools, but those left in the system after this selection may be extraordinary.[1] Another explanation might be that there are more visible cash-paying employment opportunities for secondary students in cities, not necessarily full-time, career-type jobs but attractive, casual, part-time work. In rural areas with an oversupply of labor, employment may not be found so easily. Still another explanation is that a secondary school diploma for the rural boy may be viewed as a one-way ticket to the cities. Obviously, these are questions that require further study. It should be noted, however, that workers in the two factories with secondary education in rural schools succeeded in school more often than workers with the same education in towns and cities.

Variables Related to Years of Schooling. Other writers have suggested a number of factors that are related to years of educational attainment. These include place of residence (urban-rural environment), father's occupation and education, religion, and caste. In addition to these variables, it seemed possible that the number of older brothers in a family could have some bearing on the education of younger sons, but this was not framed as a formal hypothesis because it was not clear what the relationship might be: a large number of sons might impose a financial strain on a father's budget, in which case younger sons might not be able to continue in school; or older brothers might be supposed to perceive first-hand the value of education and strongly encourage their younger brothers to continue; or, again, older sons might be found to be more prone to begin work earlier to increase family income, thereby enabling younger sons to stay in school longer.

To visualize the importance of these variables, a regression equation was estimated, treating education as a function of childhood residence, religion, caste, father's occupation, father's education, and total number of older brothers. The results are given in Table 12.

---

[1]UNICEF, Children and Youth in National Planning and Development in Asia, Report of a Conference, Bangkok, Thailand, March, 1966 (New York, 1966), pp. 30-32.

TABLE 12

EDUCATION AS A FUNCTION OF A NUMBER OF VARIABLES, MACH AND ENG WORKERS

Variables	MACH (N = 507)		ENG (N = 78)	
	Coefficient	R^2 Change[a]	Coefficient	R^2 Change
Number older brothers	.19*	.02	.29*	.022
Father's education	.23*	.02	.21	.023
Father's occupation	-.06	.001	.31	.021
Religion[1]				
Muslim	.33	.001	-1.82*	.06
Catholic	-.36	.003	-0.25	.002
Protestant	.39	.001	1.18	.007
Caste[2]				
Brahmin	.58*	.006	--	--
Lingayat	.61	.004	--	--
Kshatriya	.21	.001	--	--
Vaisya	1.00	.003	--	--
Schedule	.09	--	--	--
Environment[3]				
City	-0.03	--	.29	.002
Farm	.17	.002	1.73*	.02
Constant	9.34		7.938	
Total Variance Explained		.062		.157

a R^2 equals the percentage of variance in years of education explained by the independent variable.

* Significant at $P < .05$.

[1]Relative to Hindu.

[2]Relative to Sudras.

[3]Relative to district town.

The number of older brothers is positively and significantly related to the worker's years of schooling, so the proposition that workers with more older brothers tend to have less education was not supported. It could be inferred that workers with a larger number of older brothers generally have had more education. In both MACH and ENG there is a stronger positive relationship between farm village and years of schooling than between main cities and years of schooling. Therefore, we would conclude that workers in both plants from villages generally have had more education than workers from towns and cities.

Father's occupational category among MACH workers has a negative association with the worker's educational attainment. This probably reflects the large percentage of MACH fathers who were engaged in agriculture or mining; and, as we have seen, workers who attended secondary schools in agricultural areas were the most successful in school. In ENG, in contrast, where there were fewer fathers involved in agriculture, there is a positive relationship between father's occupation and years of schooling.

In the equation, father's education also is significantly and positively related to educational attainment (although it was not statistically significant in ENG)--the higher the father's education, the higher the son's. Table 13 exhibits this trend clearly.

Although the coefficients for religious groups are not statistically significant, they still represent the best estimates for the data. In both plants Protestants seem to have more education than Muslims and Catholics. Because of the negative coefficients for Catholics in MACH and for Catholics and Muslims in ENG, it appears that Hindus were more educated than Catholics in both firms, and more educated than Muslims in ENG.

The relationship of caste and years of schooling seems rather clear from our regression equation. If the Vaisya caste is omitted (as it probably should be because there were only seven cases in this category), the rank order of castes as they relate to 0-8 years of education almost parallels their religious-social ordering; that is, Brahmins and Lingayats tend to have more education than all others, followed by Kshatriyas and scheduled caste members. It should be noted that the coefficients for these were computed relative to Sudras, and that therefore Sudras have the least education of all. Table 14 shows the distribution of castes by three educational categories.

It was surprising to find such a large percentage (88.3) of workers from scheduled castes with nine and more years of education, but this finding may indicate that only exceptionally well-educated scheduled caste members are able to obtain employment at MACH.

TABLE 13

DISTRIBUTION OF WORKER'S EDUCATION BY FATHER'S EDUCATION

	Father's Education				
Worker's Education	None	0-4	5-9	10-12	13 and above
MACH[a]					
0-8	24.5%	25.0	12.1	9.2	0.0
9-11	69.1%	61.9	75.9	77.6	64.7
12 and above	6.4%	13.1	12.0	13.2	35.3
Number	188	84	141	76	17
ENG[b]					
0-8	44.0%	7.7	33.3	27.8	0.0
9-11	40.0%	76.9	50.0	50.0	0.0
12 and above	16.0%	15.4	16.7	22.2	100.0
Number	25	13	18	18	4

[a] $x^2 = 31.35$, df = 8, $P < .001$, C = .24.

[b] $x^2 = 21.71$, df = 8, $P < .05$, C = .47.

TABLE 14

YEARS OF EDUCATION BY CASTE, MACH WORKERS[a]

Years of Education	Brahmins (69)	Lingayat (27)	Kshatriya (28)	Vaisya (7)	Sudra (216)	Scheduled (34)
0-8	5.8%	3.7%	21.4%	0.0%	23.1%	11.8%
9-11	79.7	74.1	64.3	100.0	67.1	82.4
12 and above	14.5	22.2	14.3	0.0	9.7	5.9

[a] $x^2 = 23.37$, df = 10, $P < .01$, contingency coefficient = .24.

To summarize, the data show that mean years of education is high among MACH and ENG workers, and is increasing among younger workers; that workers with rural secondary schooling tended to pass secondary school more frequently than workers with urban backgrounds; and that years of schooling are associated with the number of older brothers, father's education, religion, caste, and childhood residence. Later we shall see how these same variables affect efficiency.

Training

As noted in Chapter II, five kinds of in-employment trade training were popular among MACH and ENG tradesmen: full apprentice training, artisan craftsmen training, in-firm learning, refresher training, and "picking-up the trade." The most popular outside-employment schemes were the ITIs and the Polytechnics.

Most workers were trained by a combination of two or more of these schemes. Altogether, 35 combinations or paths were identified.[1] However, the majority of workers fell into three mutually exclusive paths: ITI plus artisan craftsmen training (Path 1), in-firm learning[2] (Path 2), and workers who "picked up" the trade (Path 3). The mean duration of each path and the distribution of workers by path is given below:

	MACH		ENG	
PATH	Number of Workers	Mean Months	Number of Workers	Mean Months
1	214	31.3	4	22.0
2	227	29.0	52	28.2
3	33	30.8	27	--

The following paragraphs comment on the relationship between training path and some of our independent variables.

---

[1] See Appendix VII for a description of these combinations.

[2] Including full apprentice training, deployment training, and refresher training.

Age. There is a significant ($P < .01$) relationship between the age of MACH respondents and training path. Over 53 percent of Path 1 followers are under age 31 compared to 36.5 and 18.2 for Paths 2 and 3, respectively. A similar trend appears in the ENG data but is not significant.

The increasing stock of formal outside-employment training among the younger generation of workers was expected, since the emphasis in craftsmen training has moved from a traditional master-apprentice relationship to formalized training schemes with prescribed curricula, trained staff, and government sponsorship. The stimulus for this trend probably contained several elements. Master-apprentice arrangements, which involved small instructor-pupil ratios could not meet the demands for skilled labor in a rapidly industrializing economy. At the beginning of the twentieth century this problem was considered in India by a committee on education, which recommended that vocational training in firms and institutes be established to supply large-scale employers, such as railways, public works, and textile mills, with needed manpower.[1] In later years a number of large firms were providing such training, but at the same time many small firms were unable to devote resources to what was considered a relatively nonproductive activity. Given the inequalities of resources that could be used by firms for training and the concommitant differences in the quality of training offered, it was not surprising that the Government intervened in an effort to standardize training and to provide resources for craftsmen training in areas where in-firm training could not meet manpower demands. Today the Government is furthering the trend of standardizing trade training by promoting apprentice and ITI training. But the crucial question is whether this is a desirable trend, an issue we shall examine in the following chapter.

Caste. There is a weak and insignificant association between training path and caste in MACH. Nevertheless, Table 15 suggests that there is a higher proportion of Brahmins, Lingayats, and Kshatriyas (the higher castes) among workers with ITI training, and a smaller proportion of Sudras. It is interesting to note that among MACH workers with ITI training, there is a larger percentage of scheduled caste members than in Paths 2 and 3. This reflects the Government's policy of setting aside 13 percent of ITI capacity for members of scheduled castes and tribes.

---

[1]Recommendation of the Clibborn Committee in 1902-1903. See Moon Yong Lee, A Study of the Effectiveness of Vocational and Technical Education in India (unpublished manuscript, Asian Institute of Educational Planning and Administration, 1968).

TABLE 15

TRAINING PATH BY CASTE, MACH WORKERS[a]

PATH	Brahmin (61)	Lingayats (26)	Kshatriyas (21)	Vaisyas (6)	Sudras (164)	Scheduled (31)
1	57.4%	69.2%	61.9%	66.7%	42.1%	64.5%
2	37.7	23.1	33.3	33.3	48.1	25.8
3	4.9	7.7	4.8	0.0	9.8	9.7

[a] $x^2 = 15.21$, df = 10, $P < .12$, C = .22.

Father's Occupation and Education. There is a significant but mild relationship between type of training and father's occupation among MACH workers. (In ENG this trend was insignificant.) The proportion of sons with ITI training increases with the level of father's occupation up to the skilled worker level. The proportion drops slightly for workers with fathers in clerical or administrative work, and again increases for fathers who were teachers or instructors.

TABLE 16

TRAINING PATH BY FATHER'S OCCUPATION, MACH WORKERS[a]

PATH	Farmer/ Miner (141)	Unskilled Worker (69)	Skilled Worker (123)	Clerical/ Sales (22)	Teacher/ Instructor (23)	Professional (8)
1	44.0%	53.6%	57.7%	54.5%	65.2%	37.5%
2	48.2	39.2	35.8	45.5	30.4	25.0
3	7.8	7.2	6.5	0.0	4.4	37.5

[a] $x^2 = 19.7$, df = 10, $P < .03$, C = .22.

In both plants there is an insignificant association between father's education and son's training, and no trend is observable.

Years of Education. Table 17 suggests that ITI workers in MACH have had more education than "learners" (Path 2), who in turn have had more education than those who "picked up" their trade (Path 3). Similar findings emerged from the ENG data.

TABLE 17

TRAINING PATHS BY EDUCATION, MACH WORKERS[a]

PATH	Low Education (61)	Medium Education (308)	High Education (45)
1	0.9%	87.4%	11.7%
2	26.3	64.1	9.6
3	45.5	42.4	12.1

[a] $x^2 = 76.3$, df = 4, $P < .001$, C = .4.

In arguing the disadvantages of outside-employment training, some allege that vocational-technical institutes absorb the rejects and failures from the regular school system, implying that this affects trade learning and therefore presumably eventually job performance. It may be true that there is a high percentage of secondary school failures among students of training institutes--in fact, we found that 43 percent of workers who had taken ITI training had failed secondary school--but whether this affects job performance is quite another issue. Later we will see that workers with ITI plus artisan craftsmen training produce less than workers who have had Path 2 or Path 3 training. We might expect, then, that there would be a higher proportion of secondary school failures among ITI alumni than among other workers. The data, however, show the contrary, namely that there are proportionately fewer failures among ITI workers than among workers with in-firm learning who, in turn, have fewer failures than workers who "picked up" their trades. Moreover, there was no real difference in efficiency ratings between ITI alumni who had failed secondary school and those who had not. Therefore, it seems dangerous to argue that academic failure is clearly an important drawback to outside-employment training schemes.

Childhood Residence. There are few differences among workers from farm, town, and city areas with respect to the type of training path followed in either company. The proportion of workers from each type of environment who had taken ITI training, who had in-firm learning, and who had "picked up" the trade is about the same.

In summary, training path is strongly related to age and years of education and less so to educational failure. Father's education and childhood residence appear to have little association, and caste and father's occupation prove to be only mildly related.

CHAPTER V

PRODUCTIVITY AND ITS RELATIONSHIP TO EDUCATION, TRAINING, AND EXPERIENCE

Thus far we have examined characteristics of the workforces in MACH and ENG, and have looked at the relationship of the worker's background environment and educational attainment and choice of training path. In this chapter we turn our attention to the relationship of worker productivity and education, training, and trade experience, and consider the historical pattern of substitutability between education, training, and experience in preparation for turning, milling, and grinding trades. The chapter concludes with an analysis of the costs of alternative training paths.

To estimate the association of education, training, and experience with productivity, a regression equation was computed, treating efficiency as a function of the following variables: education, training, trade experience, SES, age, religion, caste, childhood residence, number of dependent family members, job satisfaction, and career aspirations.[1] The results of education, training and experience are summarized in Table 18.

---

[1]The full results of these computations can be found in Appendix VIII.

POOR ORIGINAL COPY - BEST AVAILABLE AT TIME FILMED

TABLE 18

THE RELATIONSHIP OF EDUCATION, TRAINING, AND EXPERIENCE TO EFFICIENCY, MACH AND ENG WORKERS

Variables	MACH Coefficients	ENG Coefficients
Years education	.72[a]	.70
Months training	.03	-0.10
Years trade experience	-.28	.57

[a]Significant at $P < .05$.

Education and Efficiency

Table 18 shows that education is statistically significant and positively associated with productivity in MACH; that it is also positively related with productivity in ENG but is statistically insignificant; and that the coefficients for education are remarkably similar in both plants.[1] At the same time, the data show that the effect of education on efficiency is small: an additional year of schooling would increase efficiency levels only .72 of 1 percentage point in MACH and .70 of 1 percentage point in ENG.

Since a number of writers have stressed the importance of secondary education (three years beyond middle school) as a pretraining phase of preparation for skilled and technical work, it was of interest to see whether there would be a marked reduction in efficiency if the mean of education was reduced to eight years, the level at which middle school is completed. In fact, by making this reduction and multiplying it by our education coefficients, levels of efficiency drop by only 1.49 and 1.28 percentage points in MACH and ENG, respectively. Thus,

[1]Even though statistically insignificant, the ENG coefficients are still the best estimates for the data.

the importance of secondary education that adds less than 1.5 percentage points to efficiency levels is at least questionable in preparing for turning, milling, and grinding work.[1]

On the whole these findings support the hypothesis that general education is positively--but weakly--related to efficiency.

Training and Efficiency

With respect to training, Table 18 shows that the relationship between months of training and efficiency is statistically insignificant, and that the coefficients are positive in MACH, and negative in ENG. Even if the relationship were significant, the positive coefficient for MACH is so small as to suggest that additional months of training would result in very small increases in efficiency: it would take 33.3 months of additional training to increase efficiency by 1 percentage point (1/.03). Moreover, if we disregard all other variables in our equation (which we have held constant) and look only at the coefficients of correlation between efficiency and months of training, there appears to be almost no association. The coefficients are .006 for MACH and -.044 for ENG. In short, the evidence is heavily against the possibility of efficiency and months of training being intimately related.

This is not to say that training is unimportant. Months of training may be unrelated to efficiency, but the quality or kind of training may make a measurable difference. As noted earlier, three training paths were popular among MACH and ENG tradesmen: Path 1 (ITI plus artisan-craftsmen training), Path 2 (in-firm learning), and Path 3 ("picking up the trade"). We estimated the relationship between training path and efficiency by computing a regression equation with efficiency as the dependent variable.[2] The coefficients for these training paths and their significance is exhibited in Table 19, and in the following table (20) the mean levels of efficiency for the three paths are given.

---

[1]Only the effects on productivity of marginal changes in education can be predicted with some confidence. Predictions based on gross changes would be dangerous because there may well be an education level below which efficiency would drop drastically. By reducing years of education to eight, I have not reached any such level, as evidenced by the large numbers of workers who have had that amount of education and who produce reasonably efficiently.

[2]See Appendix IX for a summary of the results of these equations.

TABLE 19

THE RELATIVE RELATIONSHIP OF TRAINING PATHS TO EFFICIENCY, HOLDING EDUCATION, EXPERIENCE, AND ENVIRONMENTAL VARIABLES CONSTANT, MACH AND ENG WORKERS

Path[a]	Coefficients	Coefficients
1	0	Too few cases
2	6.21*	0
3	7.11*	1.08

[a]The coefficients for Paths 2 and 3 in MACH are computed relative to Path 1, and the coefficient for Path 3 is computed relative to Path 2.

Significant at $P < .05$.

TABLE 20

MEAN EFFICIENCY BY PATHS, MACH AND ENG WORKERS

Path	MACH	ENG
1	60.1	--[a]
2	62.6	78.7
3	62.8	78.4

[a]Too few cases.

Table 19 shows a significant relationship between training paths and worker productivity in MACH. It suggests that generally Paths 2 and 3 (representing in-employment training) are superior to Path 1 (outside-employment training), adding respectively 6.21 and 7.11 percentage points more to efficiency, holding other variables constant at their means. Path 3 is also a better path in ENG.

But given the small percentage of efficiency variance explained by training paths, some might ask, why be concerned about any of them? There are several reasons why we should not be preoccupied with the amount of variance explained. First, some variables that are significantly linked to efficiency and explain much of the variance (for instance, wage grade, which in MACH accounted for over 30 percent of the explained variance) are likely to be rewards for and not the causes of efficiency; even though training explains much less variance, it may in fact contribute far more to efficiency than wage grade level. Second, other variables may have such small coefficients (for example, age) that only dramatic increases in variable size would affect worker efficiency and these increases may be simply prohibitive. Still other variables may not be subject to change or manipulation, e.g., caste, religion, and childhood residence (here the worker himself can do virtually nothing, although an employer can favor or discriminate against workers for these attributes in his hiring practices).

In any event, training can be changed, and therefore it is important to consider which paths exert the strongest influence on efficiency. Paths 2 and 3 appear to be the best alternatives, and Path 1 the least desirable. From this data it can be inferred that workers with inside-employment training produce measurably more than workers with mainly outside-employment training, as represented by Path 1. Information collected during interviews with supervisors adds further support to this inference. Of 39 supervisors in MACH who were responsible for groups of workers in which both types of training were represented, 25 believed that workers with in-employment training were noticeably more productive. In a later section of the paper we will consider possible reasons why these workers are better producers.

Experience and Efficiency

Trade experience is probably more related to productivity in earlier years on the job than in later years, since it is during the first years that the bulk of job knowledge and skill is acquired. In later years the learning curve may flatten out as incremental additions of knowledge and skill become less and less. This is a difficult point to prove from our data. Table 18, however, provides a few hints, notably the negative relationship between productivity and experience

in MACH and the positive relationship between the two in ENG.[1] The MACH finding may reflect the fact the company has not recruited turners, millers, and grinders in recent years, so that the learning curve for employed workers has already flattened, as suggested above, or possibly even declined. There could be other reasons why workers with more experience perform less well than younger ones. Younger workers may have acquired production techniques that older workers have not picked up. Declines in physical endurance and mental fitness may impair the efficiency of older workers. And there may be some attitudes among older experienced workers that are not conducive to productivity. For example, many of the older workers at MACH seemed dissatisfied with promotion system: they felt they had reached a maximum level in the company and could go no further, even though they were 15 to 20 years away from retirement. Dissatisfaction of this kind may result in lower productivity.

ENG, in contrast, has expanded steadily and recruited regularly. With a certain number of new recruits entering the work force each year, some number of men might be expected to be at the lower end of the learning curve at any given time, where the rate of acquiring job knowledge and skills is the highest.

We conclude from the data that the association of efficiency and experience is not clear, but presumably it may have a positive and significant association in earlier years.

To sum up, education is found to be significantly related to worker production, although its contribution is small. Months of training seem to have little association with efficiency, but kinds of training (paths) are significant and important determinants of productivity. The association of efficiency and years of trade experience is unclear, but it is presumed that the effects of experience on efficiency dwindle over time.

---

[1]Although the negative relationship in MACH is not quite statistically significant in Table 18, it does become significant in the equation used for Table 19 (see Appendix IX).

Historical Tradeoffs between Education, Training, and Unskilled Experience

Is there any trend in substitutability between education, training, and unskilled experience, as reflected in the job preparation of different age groups of MACH and ENG workers (experience in this context refers to work experience prior to the point at which the worker became a recognized skilled tradesman)? Table 21 suggests several trends: first, that the stock of education has steadily increased; second, that years of training increased noticeably and appear to have levelled off; third, that years of unskilled experience have declined. It might be inferred therefore that education and training have to some extent substituted for unskilled work experience. Table 21 also shows that the overall duration of trade preparation (training plus unskilled experience) has been reduced by several years.[1]

Another interesting question is, what degree of substitutability exists between education, training, and trade experience relative to levels of productivity (here we are concerned with total trade experience, since this may affect present efficiency levels)? Returning to Table 18 on page 50, and comparing coefficients, we see that in MACH two additional years of training (.03 x 24 months) would equal one year of education (.72), and that in ENG 1.23 additional years of experience (.70/.57) are worth one year of education. In other words, it can be predicted that a work force with a little more education and a little less training and experience could maintain present efficiency levels or possibly increase them.

From a policy viewpoint, however, it would be a mistake to conclude that education should be increased to stimulate efficiency. Before investing in education, one would want to know what costs were entailed in additional years of education and whether the discounted returns resulting from predicted increases in efficiency would justify those costs (regrettably, we did not have cost data on schooling). Another consideration would be the costs of increasing training and trade experience and the relationship of those costs to returns. Generally, the per trainee costs of vocational-technical training institutes are several times higher than education costs, but the

---

[1]Our concern is with marginal changes, for example, a little more training as a substitute for a little less unskilled experience. Clearly, it would be unrealistic to substitute one element for another entirely, even though it may appear to be statistically important, since there is undoubtedly a minimum level of education, training, and experience below which a worker could no longer do skilled work.

TABLE 21

THE STOCK OF EDUCATION, TRAINING, AND EXPERIENCE FOR WORKERS IN DIFFERENT AGE GROUPS, MACH AND ENG

	46 and older	41-45	36-40	31-35	26-30	25 and under
MACH						
Years of Education	8.0	8.06	9.5	10.2	10.3	10.3
Years of Training	1.8	2.4	2.3	2.3	2.4	2.3
Years of Unskilled Experience	9.0	5.4	5.2	2.6	1.5	0.6
Training plus Unskilled Experience	10.8	7.8	7.5	4.9	3.9	2.9
ENG						
Years of Education	8.0	9.1	9.1	9.2	10.5	11.7
Years of Training	1.0	1.7	2.1	2.1	1.5	2.3
Years of Unskilled Experience	6.0	4.5	2.9	2.3	1.3	1.3
Training plus Unskilled Experience	7.0	6.2	5.0	4.4	2.8	3.6

costs attached to experience may be much less than education costs because the worker is producing while acquiring attributes that eventually enhance his efficiency.[1]

In summary, education and training are increasing among younger workers, while unskilled work experience is declining. Relative to productivity we find that a year of education is at least twice as important as a year of training in MACH, and 1.23 times the value of one year of experience for workers in ENG.

Productivity and Combinations of Education and Training

Thus far, we have examined the separate effects of education, training, and experience on productivity. It would be desirable to consider the combined effects on productivity of all these elements, but because the relationship of trade experience and productivity is not clear and is statistically insignificant in most of our equations, we shall confine analysis to combinations of education and kinds of training, both of which are significantly related to efficiency.

Workers were divided into three groups representing different levels of educational attainment: low (0-8 years), medium (9-11 years), and high (12 years and above). Regression equations were estimated for each group with efficiency as a dependent variable and kinds of training, trade experience, SES, religion, caste, and childhood residence as independent variables.[2] The differences in the amounts of efficiency that would be added by increasing the proportion of workers in each path by a percentage point relative to the others are given in Table 22.

---

[1] Staley, op. cit., p. 119.

[2] See Appendices X, XI, and XII for full results of these equations.

TABLE 22

INDEX OF RELATIVE PERCENTAGE POINT ADDITIONS OF PATHS 1, 2, AND 3 TO EFFICIENCY FOR WORKERS WITH LOW, MEDIUM, AND HIGH EDUCATION, MACH AND ENG WORKERS

Paths	Low Education	Medium Education	High Education
MACH			
1	--[a]	0	0
2	-8.52*	4.86*	4.15
3	0	-0.14	13.44*
Efficiency means	58.26	61.77	69.75
ENG			
1	--	-0.61	--[a]
2	10.23	1.19	--[a]
3	0	0	--[a]
Efficiency means	77.72	85.18	

[a]Insufficient cases.

*Significant at $P < .05$.

The results are striking and in some cases statistically significant. Even after holding trade experience and environmental variables constant at their means, Path 2 (in-firm learning) adds more to efficiency than Path 1 (ITI) in the medium and high education levels in both factories. Path 3 ("picking up the trade") and Path 1 are nearly equivalent for workers with medium levels of education, but Path 3 is significantly better than Path 1 for workers with higher levels of education in MACH. Since Path 3 involves personal initiative and observation, it is not surprising that its contribution to efficiency relative to Paths 1 and 2 is larger in the high education category.

Which combinations of education and training maximise efficiency? Our equations suggest that Path 3 workers with high education are the best producers. If all highly educated MACH workers had Path 3 training, mean worker productivity would rise from 69.75 to 80.5 percent. The second best alternatives for MACH are Path 3 with low education and Path 2 with medium education. These combinations would increase efficiency from approximately 58-60 percent to almost 65 percent for workers who fall into the low and medium education categories. Path 2 with low or medium levels of education would be productive combinations for ENG.

Predictions of efficiency increases are risky and are reported here only to illustrate possible differences in the contributions of alternative combinations of education and training. Our main interest is in comparing these alternatives, and we can say with confidence that Path 1 is inferior to Path 2 in medium and high levels of education, and inferior to Path 3 in high levels of education. In other words, exclusively in-employment training would seem to be a better bet to increase efficiency than outside-employment training, a finding that confirms our hypothesis.

Why is Path 2 superior to Path 1?[1] Do differences in job performance reflect differences in job knowledge, skills and attitudes, or environmental backgrounds? To answer this question we compared workers who had followed these two paths and who also had nine to eleven years of education along a number of dimensions, including general trade ability (measured by trade test scores), SES, religion, caste, childhood residence, age, trade experience, wage grade, job satisfaction and job aspirations. Table 23 presents the means of some of these variables for the two paths by level of efficiency.

---

[1]Unfortunately there were too few cases in Path 3 in MACH to analyze closely why this path was consistently better than Path 1 and sometimes better than Path 2; also there were insufficient cases in ENG, so analysis of differences is concerned with MACH workers only.

TABLE 23

MEANS OF INDEPENDENT VARIABLES FOR
DIFFERENT EFFICIENCY[1] LEVELS FOR MACH WORKERS WITH
PATH 1 AND PATH 2 TRAINING AND 9 TO 11 YEARS OF EDUCATION

	PATH 1			PATH 2		
VARIABLES	Low Eff. (50.8)	Average Eff. (60.04)	High Eff. (74.9)	Low Eff. (53.4)	Average Eff. (65.05)	High Eff. (80.68)
Wage Grade	2.60	2.71	2.87	2.18	2.16	2.39
Experience Tr.	8.40	8.19	7.82	9.44	8.76	7.77
Aspirations	5.95	6.02	6.12	5.27	5.40	5.57
Job Satisfaction	7.88	7.73	7.47	7.75	7.69	7.61
Age	30.60	30.60	30.53	31.5	31.67	31.9
SES	5.27	4.91	4.32	4.19	4.30	4.45
Caste						
Brahmin	.18	.18	.17	.17	.15	.11
Lingayat	.10	.07	.03	.03	.04	.05
Kshatriya	.04	.06	.09	.03	.03	.02
S/C	.08	.10	.13	.06	.06	.05
Environment						
Farm	.15	.21	.30	.19	.22	.25
City	.40	.36	.30	.57	.55	.52
Religion						
Catholic	.03	.03	.01	.06	.07	.09
Protestant	.03	.03	.03	.02	.02	.02
Muslim	.10	.11	0	.04	.03	NA

[1]It is interesting to note that Path 2 workers have higher efficiency means at each of the three productivity levels.

There were no significant differences in trade ability, so we assumed that there was no difference in job knowledge and skills between workers with Path 1 and Path 2 training.

We next examined background environmental variables, and in looking at between-path differences, we found that on the average Path 2 workers have had slightly more trade experience and are older than Path 1 workers, but their wage grade means are lower, as are their job aspirations. Curiously enough, Path 2 workers, who are better producers, generally have lower wage grades, a point to which we shall return later. Job satisfaction for both paths is similar. Socioeconomic status, as we defined it, is somewhat higher for Path 1 workers. The distribution of religions and castes is uneven. Among Path 1 workers there is a larger proportion of Brahmins, Lingayats, Kshatriyas, and schedule caste members, whereas in Path 2 Sudras strongly predominate in number. There are also proportionately more Muslims and Protestants in Path 1, more Catholics and Hindus in Path 2. The percentage of workers with a rural background is nearly equivalent in both paths.

Turning to changes within each path that accompany increased efficiency, we find interesting similarities between the two paths: wage grade, job aspirations, job satisfaction (lower numbers mean higher satisfaction on our scale), and the percentage of workers from farm backgrounds all increase with rises in efficiency. There are also consistent declines within both paths: years of trade experience, the percentage of Brahmins, and the percentage of workers of city origin.

Do these differences account for higher levels of efficiency among Path 2 workers? To test the significance of these variables and their strength as explainers of variance in efficiency, regression equations were computed for both paths, keeping education as a parameter and treating efficiency as a dependent variable. The results are summarized in Table 24.

The differences in job aspirations, trade experience, age, SES, and caste found in Table 23 do not as a whole explain why Path 2 workers have higher levels of efficiency than Path 1 workers. This was tested by inserting the mean values of all variables for the Path 1 - medium level education equation in Path 2 - medium level education equation, and vice versa (see Table 24). By substituting Path 1 means in the Path 2 equation, efficiency was raised three percentage points, to 68.2. When Path 2 means were entered in the Path 1 equation, efficiency dropped by 4.03 percentage points, to 56.01. If the variables had been powerful reasons for the differences in efficiency, Path 2 means in the Path 1 equation would not have lowered efficiency.

What then might account for different mean efficiency levels for the two paths? One basic difference between workers with exclusively in-employment training and workers with outside-employment training is

TABLE 24

RELATION OF INDEPENDENT VARIABLES TO EFFICIENCY FOR MACH WORKERS WITH PATH 1 OR PATH 2 TRAINING WHO HAVE HAD 9-11 YEARS OF EDUCATION

	Path 1 (N = 187)		Path 2 (N = 107)	
VARIABLES	B	R^2 change	B	R^2 change
Wage Grade	7.48*	.093	6.45*	.05
Years Trade Exp.	-0.35*	.005	-1.02*	.07
Job Aspirations	-0.30	.0008	.82	.002
Job Satisfaction	-0.90	.009	-1.14	.010
Age	-0.196	.001	-0.34	.005
SES	-0.986*	.024	0.43	.003
Caste				
Brahmin	.52	-	-7.92	.02
Lingayat	-6.024	.012	5.33	.003
Kshatriya	2.96	.002	-6.97	.005
Schedule	-1.01	.0005	.89	.0001
Environment				
Farm	5.37*	.05	9.74*	.03
City	-2.31	.005	1.67	.001
Religion				
Catholic	-3.35	.001	-6.60	.007
Protestant	-2.45	.001	-	-
Muslim	.81	.0002	-11.36	.005
Constant	62.28		71.42	

Significant at $P < .05$.

that the incidence of trade change after training is much higher among the latter. Over 54 percent of workers who had had ITI training were trained in trades other than the one in which they were presently working, compared to less than seven percent of workers who had had in-firm learning. It was suspected that there might be a difference in mean efficiency levels for ITI workers who had changed trades and those who had not, and that this might lower the overall mean efficiency of Path 1 workers; however, we did not find a significant difference. It is conceivable that there were differences in the workers' early years on the job, but that these were eliminated over time with the accumulation of trade experience.

Although change of trade may not affect efficiency, it is costly and wasteful. It was reported by trade instructors in the Bangalore ITI and MACH training center that about 35-40 percent of ITI training could be considered useless if a man changed trade after training.

Since job knowledge and skills were similar for workers with the two training paths, and environmental variables were not statistically sound reasons for efficiency differences, and moreover, since changing trades did not seem to have much effect on efficiency, we hypothesized that variance in productivity for workers within occupational categories might be explained by attitudes and motivations unrelated to job knowledge and skill. Interviews with MACH supervisors tended to support this hypothesis. The 25 supervisors who believed that workers with in-firm learning or who had "picked up" their trade were more efficient than ITI workers, were asked to cite reasons why workers with the former types of training were better producers. Each supervisor was requested to rank order any four of 12 characteristics that were considered important in turning, milling, and grinding work. These characteristics included: ability to learn new jobs, trade theory knowledge, manual dexterity, practical knowledge of tools and equipment, comprehension of blueprints, speed and accuracy in workshop mathematics, technical imagination, conduct, job interest, confidence in own skills, physical endurance, and attendance. The characteristics that appeared in the top four most frequently were job interest, regular attendance, confidence in skills, and practical knowledge of tools and equipment. Job interest was ranked first most often, and conduct second. This information suggests that supervisors mainly perceive attitude differences between workers with in-employment training and those with outside-employment training. In other words, it is not different degrees of job knowledge and skills that make a difference in efficiency between the two groups of workers, but certain attitudes.

Although Table 24 may not show which variables explain the difference in productivity levels of workers with and without in-employment training, it does provide further clues about which variables influence worker productivity.

For both paths, wage grade, years of trade experience, and childhood residence are significantly related to levels of efficiency and explain the largest percentage of variance within each equation. What can be inferred from these data? First, workers with high levels of efficiency tend to be in higher wage grades within each path. Second, workers with fewer years of trade experience perform better than those with more years. As noted earlier, this may mean that the learning curve flattens out (or even declines) or that declining physical and mental fitness leads to reductions in efficiency, or that certain negative attitudes toward work and output are developed in later years (or are simply a part of the older generation work force).

A third similarity to be noted in Table 24 is that workers whose childhood residence was a farm village tend to be more efficient than workers from towns or cities. This was a significant trend in both paths ($P < .05$). Rural-urban migration literature suggests the numerous problems that rural migrants face in an urbanized society and their difficulties in adapting to factory life.[1] Whatever these difficulties, our MACH data strongly suggest existing problems, if any, are less harmful to efficiency than those of workers with a city origin. Again, we are led to infer that workers of rural origin who find skilled industrial jobs are unusually gifted.

What explains this phenomenon? There are no significant differences in trade test scores for workers from rural and city environments. However, there are differences in job aspirations and job satisfaction, though they are slight. Table 25 compares the correlation coefficients of farm origin and city origin in this connection.

Although the coefficients are very low, there are interesting similarities between paths. In both paths there is a positive correlation between job aspirations and city origin and a negative correlation correlation for job aspirations and rural origin. As for job satisfaction, it is negatively related to farm origin in both paths, positively related to city origin in Path 1, and negatively related to city origin in Path 2. All that can be said here is that there appear to be differences in attitudes toward job aspirations and job satisfaction between MACH workers of rural and city origin who have similar education and training backgrounds, so we might suspect that there may be other attitude differences to account for the better job performance of workers of rural origin.

---

[1] Wilbert E. Moore and Arnold S. Feldman, Labor Commitment and Social Change in Developing Areas (Social Science Research Council, New York, 1960).

TABLE 25

CORRELATION COEFFICIENTS FOR CHILDHOOD RESIDENCE BY JOB SATISFACTION AND JOB ASPIRATIONS

	Path 1	Path 2
Job Aspirations		
Farm Origin	- .07	- .003
City Origin	+ .008	+ .06
Job Satisfaction		
Farm Origin	- .04	- .02
City Origin	+ .06	- .14

The coefficients in Table 24 for religion and caste data are statistically insignificant but suggest that some of the between-path differences cited earlier may influence worker efficiency. In both paths, Hindus have higher levels of efficiency than other religous groups; moreover, it seems that Sudras perform better than Brahmins, schedule caste members, Lingayats (in Path 1) and Kshatriyas (Path 2).

The number of family members dependent upon the worker for livelihood does not appear to have an influence on worker productivity. In both factories relationships between dependency ratios and efficiency were insignificant. In ENG it appears that as the number of dependents rises, productivity declines--but very slightly.

Summary. Path 2 (in-firm learning) and Path 3 ("picking-up the trade") add more to efficiency than Path 1 (ITI). The best combination of education and training is some secondary education plus Path 2 or Path 3. However, we were unable to explain why Paths 2 and 3 are superior to Path 1. Since differences in the scores of tests of trade knowledge and skills for the three paths are slight, we attribute variance in efficiency to some attitude or behavior orientation not affected by knowledge and skill.

Comparative Training Costs

This section examines the relative costs of Path 1 (ITI plus artisan-craftsmen training), Path 2 (in-firm learning), and Path 3 ("picking-up the trade"). Data are based on current costs, not on the actual costs incurred in training the turners, millers, and grinders interviewed. As we were unable to obtain specific cost data from ENG, analysis is confined to MACH workers.

Training costs include two elements: direct outlays, such as equipment purchases and operating expenses, and indirect outlays, such as earnings forgone by trainees.[1] Training involves both private

---

[1]Strictly speaking, treating all forgone earnings as part of an investment in training overestimates the size of the investment, for it is likely that some aspects of training have intrinsic consumption benefits. In theory, the cost of these benefits should be subtracted from the overall training investment; in practice, however, it is virtually impossible to make this distinction. This issue is neatly discussed in Burton A. Weisbrod, "The Valuation of Human Capital,"

expenses (borne by the trainee or his family, e.g., expenditures for textbooks, transport to and from) and public expenses (borne by society, e.g., the costs of running a training institute). Private costs, other than forgone earnings, were not taken into account. It would have been almost impossible to estimate them accurately without a survey of trainees or their parents, and in any case they were probably negligible for the three training paths.

Estimating in-firm training costs of these paths is difficult, not only because it is hard to gauge the many invisible costs, such as production lost when supervisors and co-workers give advice and help to trainees, or wear-and-tear imposed on capital equipment as trainees learn their jobs, but also because it is hard to decide how much of a firm's training expenses should be added to a worker's forgone earnings to determine total training costs. Mincer argues that to avoid double counting, no expenses should be added, provided these expenses are subtracted from the worker's wages; in that event, the worker is simply buying training by taking a reduced wage.[1] However, most firms do not subtract all training costs from wages of trainees, probably on the assumption that investments in training can be recovered at a later date, possibly through increases in marginal productivity without commensurate increases in wages.

We assumed that all direct training costs and forgone earnings should be included in estimating total costs of each training path, though where there is evidence that workers are productive during training, an estimate of their productivity is deducted from training costs.

Path 1. ITI training in turning, milling, and grinding currently lasts two years. At MACH, this is followed by a year of in-plant training (artisan craftsmen training)--six months in the company's training center and six months in the factory shops. Training costs for the ITI and MACH portions of training are calculated as follows in Table 26:

Journal of Political Economy (October, 1961), pp. 425-436, and John Vaizey, The Economics of Education (New York, 1962), pp. 42-43.

[1]Mincer, op. cit.

TABLE 26

PRESENT VALUE COSTS PER TRAINEE OF PATH 1 TRAINING

	Year 1 (in rupees)	Year 2 (in rupees)	Year 3 (in rupees)
Direct costs			
Wages and salaries[a]	534	534	
Hostel expenses, excluding staff and food	7	7	
Raw materials	228	228	
Stipends[b]	105	105	
Utilities	10	10	
Depreciation[c]	143	143	
Clothing and medical	30	30	
Pro-rated costs of operating MACH training center, and trainee stipend for six months[d]			3,407
Trainee stipend for second six months, MACH training[e]			450
Indirect costs			
Forgone earnings[f]	840	840	840
Total costs per year	1,897	1,897	4,697
Total discounted costs per year[g]	1,807 (1,724)	1,724 (1,568)	4,049 (3,532)
Total discounted three-year cost			7,580 (6,824)

TABLE 26 (continued)

---

[a]ITI expenses for 1968-1969 were divided by 1,000 trainees (who were full-time).

[b]At Rs. 25 per month for 33.3 percent of trainees, pro-rated for 1,000.

[c]At seven percent of Rs. 2,044,188.

[d]It is assumed that costs in the MACH Training Center are the same for ITI graduates as for apprentice trainees.

[e]Rs. 75 per month.

[f]Rs. 70 per month. Though some boys draw a stipend, they are still forgoing earnings. Rs. 70 per month may be an overestimate in view of the three-to-five year waiting period for jobs reported by the Bangalore Employment Exchange. To be consistent, we used Rs. 70, when relevant, for each of the training paths. It is assumed that in the final six months of training at MACH (when trainees are in the shops) productivity of trainees equals the cost of supervisory time for giving boys help. Thus, their net contribution to the company's output is estimated at zero.

[g]Two discount rates were used: 5%, which probably approximates the rate at which the Government can borrow money, and 10%, which is closer to the free market rate. The figures in parenthesis are those costs which have been brought to present value using the 10% discount rate. Both rates were used to discount costs to their value at the beginning of the first year of training.

Path 2. In MACH there are two types of training programs: full apprentice training, during which trainees receive a stipend but no wages, and deployment training, during which already employed unskilled workers continue to draw full wages as they are trained for skilled jobs.

Full apprentice training at MACH is a three-year, in-employment training program for secondary school graduates. The first year is spent in MACH's training center, the remaining two years in the company shops. In the second and third years, trainees return once weekly to the training center for classroom instruction. In MACH's fiscal year 1968-69 (April-March), the center was used exclusively for the training of apprentices and indentured trainees (employees of other firms, which pay a training charge of Rs. 200 per month per trainee to MACH). During the year there were, on the average, 68 first-year apprentice trainees in the center, plus nine indentured trainees. The estimated costs of operating the training center for that year are presented in Table 27.

TABLE 27

TOTAL OPERATING COSTS OF MACH TRAINING CENTER, 1968-69

Salaries, bonus, and fringe benefits	Rs. 238,377
Raw materials	27,340
Utilities	8,200
Maintenance	6,147
Depreciation	182,400
Miscellaneous	5,805
Gross costs	468,269
Less payments for indentured trainees	(21,600)
Net costs for apprentices	446,669

This expense was allocated among first-, second-, and third-year apprentice trainees by assuming that the center was used by all trainees (only once weekly by second- and third-year trainees) one-sixth of the time, and by first-year trainees exclusively the remaining five-sixths. The average number of second- and third-year trainees in 1968-69 was 121. Therefore, one-sixth of the costs (Rs. 74,445) was divided by 189 (the total number of apprentices), giving a per trainee cost of Rs. 440. The remaining costs were charged entirely to first-year apprentices, giving a per trainee cost of Rs. 5,473. Adding these two per trainee cost figures together, we obtain a charge of Rs. 5,913 per first-year apprentice for operating the training center. To this figure, stipends and fringe benefits (including transport, medical expenses, etc.), in the amount of Rs. 75 per month per trainee, or Rs. 900 per year, had to be added, yielding a total first-year direct cost of Rs. 6,813. Discounted costs at 5 and 10 percent are Rs. 6,489 and Rs. 6,193 respectively.

The direct costs of second- and third-year apprentice training have two components, the one-sixth share of the center's yearly operating expenses, and the stipends (which are the same for all three years). Thus, Rs. 440 plus Rs. 900, or a total discounted cost of Rs. 1,218 (1,107) for the second and Rs. 1,155 (1,008) for the third year.[1]

Indirect costs of apprentice training include three years of forgone earnings (Rs. 70 per month per trainee). The discounted indirect costs amount to Rs. 800 (764) for the first year, Rs. 764 (694) for the second year, and Rs. 724 (632) for the third year.

At this point we have to introduce a cost adjustment, since second- and third-year apprentices are engaged in productive work. This presents some difficulties: it is hard to measure precisely the contribution these trainees make to the company's output because, though we have some information regarding their efficiency levels, we have none on what proportion of their time is actually spent in production work. We chose to assume that they are active in production work four-sixths of the time (basing this on the one-sixth figure for the time we know they spend back at the training center and the more-or-less arbitrary assumption that another one-sixth is spent with supervisors or co-workers in learning more about the trade).

---

[1]Hereinafter figures in parenthesis represent present value costs discounted at ten percent; those without parenthesis have been discounted at five percent.

Training-center staff report that the efficiency level of apprentices may be about 35 percent in the second year, and roughly 55 percent in the third year. Normal levels of efficiency for the company are 70 percent. To determine the value of the production of a second-year trainee, we multiply the wages and fringe benefits of a skilled worker by 35/70, times 4/6, and for the third year we multiply this wage by 55/70 times 4/6. Yearly earnings for a starting skilled worker at MACH are Rs. 3,369.

TABLE 28

YEARLY EARNINGS FOR MACH STARTING SKILLED WORKER

Basic wage	Rs. 1,380
Cost-of-living allowance	1,176
Subsidies	432
Provident fund and insurance	291[a]
Annual bonus	90
Total	3,369

[a]At 11.4 percent of basic wage plus cost-of-living.

Hence, the productive return to the company per apprentice in the second and third years is Rs. 1,123 and Rs. 1,760, respectively. Discounted returns are Rs. 1,021 (928) and Rs. 1,517 (1,323).

Table 29 summarizes discounted direct costs, indirect costs, and productive returns, and provides a net discounted training cost.

TABLE 29

NET PRESENT VALUE PER TRAINEE COSTS OF APPRENTICE TRAINING, MACH

	Year 1 (in rupees)		Year 2 (in rupees)		Year 3 (in rupees)	
	5%[1]	10%[1]	5%	10%	5%	10%
Direct discounted costs	6,489	6,193	1,218	1,107	1,155	1,008
Indirect discounted costs	800	764	764	694	724	632
Subtotal	7,289	6,957	1,982	1,801	1,879	1,640
Minus discounted production returns	--	--	1,021	928	1,517	1,323
TOTAL discounted cost	7,289	6,957	961	873	362	317

Total apprentice costs discounted at 5% = Rs. 8,612.

Total apprentice costs discounted at 10% = Rs. 8,147.

[1]Discount rates.

The second type of in-firm training, deployment training, at MACH normally includes six months in the training center and six months of supervised production experience. MACH did not provide deployment training in turning, milling, and grinding in 1968-69. It can be assumed, however, that the cost per trainee for the first six months would be approximately the same as for apprentices, or somewhat less. On this assumption, the first six months of deployment training in the center would cost half of Rs. 5,473,[1] or Rs. 2,737. To this we must add as a cost the worker's earnings during those months, for it is assumed that he is totally unproductive during this training period. The individual worker's earnings are calculated to be Rs. 1,021.44 for six months, as follows.

TABLE 30

MONTHLY EARNINGS OF MACH WORKERS IN DEPLOYMENT TRAINING[a]

Basic wage	Rs. 100.00
Cost-of-living allowance	20.50
Subsidies	36.00
Provident fund[b] and insurance	10.12
Insurance[c]	3.62
Total	170.24
Six months total	1,021.44

[a]This wage category represents the highest unskilled wage category in MACH.

[b]At 8.4 percent of basic wage plus cost of living.

[c]At 3 percent of basic wage plus cost of living.

---

[1]Estimated operating costs of the training center before other direct costs were added.

No data on the costs of supervisors' time, or raw material wastage, or machine depreciation are available for the six months of on-the-job training. As we did in the case of ITI graduates, we assumed that the productivity of deployment trainees equals the costs of lost production time of supervisors and co-workers, wastage of raw materials, and so forth. Therefore, the cost of training during this six months is the equivalent of the worker's earnings: Rs. 1,021.44. This, together with the first six months' costs (wages plus direct costs of the training center) puts the full cost of deployment training at Rs. 4,780. Discounting this cost at 5% and 10% gives Rs. 4,552 and Rs. 4,345 respectively.

Path 3. The costs of "picking-up the trade" are almost impossible to estimate because they are all indirect, and no information is available on machine wear or on the time the worker has lost while observing and imitating supervisors and co-workers. We have assumed that the costs of such training are zero. Although this is an arbitrary assumption, it is highly unlikely that it will affect our conclusions about the relative costs of training paths, in view of the comparatively high costs of other paths.

Summary and Conclusions. The costs for the different training paths are presented in Table 31.

Full apprentice training and ITI plus artisan-craftsmen training are the most expensive, though the costs of apprentice training are undoubtedly overvalued, for the MACH training center was operating well under capacity in 1968-69. If the center had accommodated the maximum number of trainees, per trainee costs of apprentice training would have dropped by Rs. 2,000, and roughly Rs. 1,000 would have been eliminated from deployment training estimates. ITI and artisan-craftsmen training would have been almost Rs. 1,000 less expensive. But even considering the inflated costs, it is clear that ITI plus artisan-craftsmen training is considerably more expensive than deployment training and Path 3. It should be noted that almost all of the Path 2 workers interviewed had had deployment training in one form or another, rather than the more expensive apprentice training. Probably the cost of Path 2 training in other firms is a good deal less than our estimates for MACH; the firm's facilities are elaborate compared to many smaller companies and other firms probably pay workers less than unskilled wages while they undergo training. I think, therefore, we can safely say that Path 1 training is considerably more expensive than training in Paths 2 (with the exception of apprentice training) and 3.

TABLE 31

COMPARATIVE COSTS OF TRAINING PATHS, MACH

PATH		Present Value discounted at 5%	Present Value discounted at 10%
1	ITI plus artisan-craftsmen training	Rs. 7,580	Rs. 6,824
2	In-firm learning:		
	Full apprentice	8,612	8,147
	Deployment	4,552	4,345
3	"Picking-up the trade"	0	0

The relative size of different cost components--training center, on-the-job, and forgone earnings--is interesting. Training center costs plainly account for the bulk of the total costs, ranging from 60 percent in Path 1 to over 70 percent for apprentice training; forgone earnings for Path 1 and apprentice training accounted for approximately 27 to 30 percent of the total costs; under our assumptions on-the-job training accounted for the smallest percentage of the total cost in all paths. From strictly a cost point of view, these findings suggest that as much in-firm training as possible be given in the shops, as opposed to in training centers.

We have insufficient data to estimate total returns on the training programs sponsored by MACH and the government. But it appears that MACH begins to recover its investment in apprentice training during the trainee's second year, at which time he is partially productive but receives only a modest stipend, which is less than his productivity. This finding adds support to our proposition that firms offering training with both specific and general elements attempt to recover some of their training investment during the training period.

CHAPTER VI

EDUCATION, TRAINING, RECRUITMENT, AND PROMOTION

As we have noted, the kinds of training path followed seem to make a difference in worker efficiency, whereas years of education add only marginally. But what is the relationship of promotion and ITI training and in-firm learning, and to what extent is level of education important in obtaining promotions?

Recruitment

MACH prefers ITI certificate holders for skilled work in turning, milling, and grinding.[1] This is company policy. Moreover, following one year of in-employment training at MACH, ITI workers are started at the same wage level as experienced workers who have learned their trade elsewhere. Why this preference when ITI graduates are not the most efficient workers? One answer might be that MACH is recruiting for careers rather than specific jobs, and in this connection supposes that ITI men have more supervisory and managerial potential than other recruits. The fact is, however, that neither the training offered at ITIs nor the background of MACH's present supervisory personnel support any such supposition. ITI training focuses heavily on developing skills in a single trade, with some exposure to allied trades; virtually no time is devoted to techniques of supervision. The objectives of ITI training, as stated by the Directorate General of Employment and Training, are to ensure a steady flow of skilled workers to industry, to raise the quantity and quality of production, and to reduce unemployment among educated youth--no mention is made of supervisors.[2] Further, it is clear that MACH does not in fact recruit ITI men with a view to moving some of them eventually into supervisory

---

[1] And most ITI workers have had secondary education.

[2] Government of India, Directorate General of Employment and Training, Report of the Progress in the Craftsmen and the Training Programmes Up to March, 1966 (New Delhi, undated, mimeo).

positions. Company policy favors graduates of polytechnics (a three-year, post-secondary engineering course) for such positions. Of 41 MACH supervisors interviewed, only four had ITI training against 27 who had graduated from polytechnics, nine who had acquired their trade as "learners" (a category that was found almost exclusively in the older age group of supervisors), and one who had had university engineering courses.

The recruitment picture at ENG is somewhat different. Again it might be supposed that ENG, a private firm unhampered by Government policies, is in a better position to recruit on the basis of expected performance. At ENG recruitment policy does not emphasize any specific training path.[1] Recently, ENG has been hiring apprentices who have been trained in its plants. This is understandable. Under the terms of the Apprentices Act, ENG has been training one apprentice for every seven employed tradesmen (though the firm is not obliged to hire trainees after training is completed).[2] After investing in the training of apprentices, ENG would surely want to recoup its training costs by making use of these workers wherever there are vacancies. As noted, Becker has suggested that some of these training costs may be recouped by keeping the wages of trainees below productivity levels during, and for some time after, training; we showed in Chapter V that MACH actually does this and it is likely that ENG does too.

Promotion

It is difficult to pinpoint what ingredients are considered fundamental to MACH's promotion policy, and to assess the relative importance of those ingredients. MACH-union contracts do not contain clauses specifying the details of the promotion policy. (The Ministry of Industrial Development and Company Affairs has provided some guidelines for promotion in public sector firms, which, among other things, stress union cooperation, periods of eligibility, the importance of recommendations of committees rather than individuals, and merit rating.) According to MACH management, when a vacancy occurs, candidates who have been in their present job for a prescribed period of eligibility (generally two years in metal cutting trades) and have met disciplinary requirements are considered on a "merit-seniority" basis.

---

[1] Nor education level.

[2] MACH also trains apprentices, but very few have been hired during the past three years because there have been few vacancies for turners, millers and grinders.

Table 32, based on responses to an open-ended question concerning the factors that determine promotion, exhibits the workers' confusion about the promotion policy.

TABLE 32[1]

MACH WORKERS' VIEW OF DETERMINANTS OF PROMOTION

Bases of Promotion	Mentioned Percent	Not Mentioned Percent
Efficiency	44.5%	55.5%
Seniority	41.5	58.5
Attendance	20.0	80.0
Conduct	17.0	83.0
Cooperation with supervisor	6.2	93.8
Level of education	5.1	94.9
Kind of training	2.2	92.8

Although there appears to be some question among workers about the importance of efficiency and seniority, there is substantial agreement that neither education nor training effect promotion. It is interesting to note parenthetically that over 40 percent of the respondents believed that the company's policy was not consistently and equally applied.

Apart from the workers' views and management's conception of the promotion policy, what in fact were the relative roles of merit, seniority, education, training, and other factors? Table 33, based on a regression equation treating wage grade as a function of a number of different variables, is suggestive of what is actually important in moving up in the metal trades at MACH and ENG.

---

[1]N = 504. Workers could mention more than one basis, if they wished.

TABLE 33

VARIABLES RELATED TO WAGE GRADE LEVELS,
MACH AND ENG WORKERS

	MACH (N 497)		ENG (N 81)	
Variables	B	R^2 Change	B	R^2 Change
Efficiency	.009*	.03	.001	.003
Years in Firm	.10 *	.006	.051	.02
Trade Experience	.08 *	.01	.152	.01
Age	.05 *	.001	.033	.008
Job Aspirations	.11 *	.04	.061*	.03
Job Satisfaction	.007	--	-.012	.0004
SES	.006	--	.010	.0005
Caste[a]				
Brahmin	.15	.003	--	--
Lingayat	-.08	.0006	--	--
Kshatriya	-.080	.0001	--	--
Schedule	-.039	--	--	--
Religion[b]				
Muslim	-.226	.005	.264	.008
Catholic	-.331	.003	-.223	.014
Protestant	-.439	.002	-.785*	.027
Education	-.019	.002	.010	.0007
Training Paths[c]				
Path 1 (ITI)	.504*	.11	-.715*	.06
Path 3 ("picking-up")	-.045	.0002	-.684*	.23
Age-Trade (interaction variable)	-.002	.02	-.003	.01
Age-Year Firm	-.007	.14	--	--
Total Variance Explained		.3729		.4216

*Significant at $P < .05$.

[a]Relative to Sudra.

[b]Relative to Hindu.

[c]Relative to Path 2 (in-firm learning).

According to Table 33, in MACH the kind of training path followed, which accounts for almost 30 percent of the explained variance, is strongly related to wage grade. This finding is in striking contrast to the impression workers have of the weak role of training in promotion, as suggested by Table 32. ITI plus artisan-craftsmen training accounts for a large proportion of explained variance and is significant and positively related to wage grade. The coefficient for ITI training was computed relative to "learner" training and therefore ITI training is more important in getting promoted than in-firm learning or "picking-up the trade," even though workers who followed these latter paths were more efficient producers. Since seniority, age, and efficiency are held constant at their means, it can be inferred that ITI workers have moved up the promotion ladder faster than either "learners" or those who "picked up" their trade.

The preponderance of ITI workers in higher wage grades in MACH may partly account for the relatively small part efficiency plays in explaining variance in wage grade (though it is significant), for ITI workers tend to be poorer workers.

Variables in the MACH equation pertaining to education, religion, and caste are statistically insignificant. However, they still represent the best estimate of coefficients for the data, and so deserve comment. The association of years of education and wage grade is weak and negative, suggesting that education is not an important element in obtaining promotion. Since the coefficients of variables concerning religious groups were computed relative to adherence to Hinduism and are all negative, it seems that Hindus have a better chance in the promotion system. The same is true of two castes--Brahmins and Sudras[1]--because the coefficients of Lingayats, Kshatriyas, and schedule castes are all negative relative to Sudra. Since efficiency, seniority and age, and education and training are held constant, the coefficients for Hindus, and Brahmins and Sudras in particular, may suggest some favoritism. In fact, over 60 percent of the MACH workers indicated that favoritism affected promotions, and of those who gave reasons, 60 percent referred to caste.

It is less clear what factors affect advancement in ENG. Plainly, workers with ITI training and those who have "picked up" their trade are at a disadvantage compared to "learners" (ITI and "picked up" their trade were computed relative to "learners"). The coefficient for "picking up" their trade (Path 3) is significant and negative and accounts for most of the explained variance.

---

[1]The coefficients of castes mentioned in the tables were calculated relative to Sudra.

Seniority is significantly and positively related to wage grade in ENG, and years of education are weakly related. Efficiency, though not significant statistically, also is associated with wage grade. The weak relationship of efficiency might be explained by the fact that in the ENG tool room there are only three main wage grades into which a worker can fall. Therefore, the number of promotions possible in ENG is less than in MACH, and ENG workers tend to spend a longer time in each grade. Many ENG workers have already reached the maximum level within their grade and have stagnated--this was true of 39 percent of ENG workers interviewed. Many of these workers appeared to be discontented, a feeling that may have affected their efficiency.

However, the finding most relevant to our analysis is that workers with in-firm training (who are the best producers) seem to have the best chance to move ahead in the ENG tool room, while workers in MACH with ITI plus artisan-craftsmen training (who are relatively poor producers) are promoted more rapidly. In view of the lower efficiency levels of ITI workers, it might be said that MACH's policy is based in part on an artificial standard--the holding of a national trade certificate.

Do these findings shed any light on the hypothesis that general education and outside-employment training are associated in a positive way with promotion, even though they may have little bearing on efficiency? The answer depends on what levels of promotion are in question. Supervisors have significantly more years of education than skilled workers--11.8 mean years for supervisors compared to 10.2 and 9.8 for workers in MACH and ENG, respectively. However, as the coefficients in Table 33 suggest, within skilled labor categories years of education seem to have little bearing on promotion.

The association of outside employment training to promotion cannot be generalized from our data and probably depends on the factory. On one hand, at MACH Path 1 training is highly and significantly associated with wage grade advancement. A definite trend to recruit supervisory staff from polytechnics (outside employment) is also evident there. In other words, outside-employment training clearly seems to make a difference in MACH at both the skilled and the supervisory level. In ENG, on the other hand, outside-employment training is significant and negatively related to wage grade in skilled occupations. Too few ENG supervisors were interviewed to provide a clear view of what kinds of training were related to supervisory positions.

As a result of the differences between the two firms, perhaps our hypothesis should be redefined as follows: outside-employment training tends to be more positively related to promotion in public

sector firms than in private sector firms. The part of the hypothesis dealing with education as an important variable in promotion must be rejected on the basis of our data.

CHAPTER VII

CONCLUSIONS AND SOME IMPLICATIONS

Several studies have related education and training to economic growth, but few attempts have been made to empirically determine what kinds and levels of education and training produce the best workers in specific occupations. In India, workers in skilled categories have acquired their job know-how through a variety of education, training, and work experiences. The purpose of this study was fourfold: first, to identify the kinds of education, training, work experience, and other characteristics of workers in skilled metal cutting occupations; second, to examine the relationship of worker productivity and different education, training, and work experiences, holding constant a number of variables, including socioeconomic status, religion, caste, childhood residence (farm, town, or city), number of dependent family members, age, job satisfaction, and job aspirations; third, to assess the relative costs of different training paths; and fourth, to see to what extent the educational attainment of skilled workers and choice of trade training path were related to selected environmental variables.

Worker productivity was measured by efficiency ratings, computed by dividing estimated standard (normal) hours for job completion by actual hours of work. Data for the study was collected from interviews with 598 turners, millers, and grinders in two large modern firms in Bangalore.

The study's major findings are summarized below:

1. The work forces in both plants were extremely heterogeneous in education, training, previous work experience, age, religion, caste, SES, and childhood residence.

2. It appears that education and training have increasingly substituted for unskilled work experience in job preparation, for mean years of education and training have risen among the younger workers while years of unskilled experience have steadily declined. Also, the total duration of trade preparation seems to

have been shortened for younger generation workers.

3. Education was positively related to worker productivity but its contribution was small. It was estimated that one year of schooling added to existing mean levels of education (10.4 in MACH and 9.8 in ENG) would increase worker productivity by only .7 to 1 percentage point.

4. Months of training and years of trade experience were not clearly related to productivity.

5. The combination of education and training found most likely to increase productivity was some secondary education plus in-employment training.

6. Altogether there were 35 different training paths represented among the workers, but the majority had followed one of three: ITI plus artisan-craftsmen training, in-firm learning, or "picking-up the trade." Training path was significantly and strongly related to productivity. Workers with in-firm learning or those who had "picked up" their trade through observation and imitation, maintained higher efficiency levels (up to 4-5 percentage points) than workers who had ITI plus artisan-craftsmen training, holding constant experience, wage grade, age, SES, religion, caste, childhood residence, job satisfaction, and job aspirations.

7. Workers with ITI training were promoted more rapidly in MACH than workers with in-employment training, even though the ITI graduates were less productive. Type of training seemed more important than efficiency as a criterion for promotion.

8. The discounted costs of outside-employment training (ITI plus artisan-craftsmen training) were higher generally than in-employment training costs.

9. MACH begins to recover its investment in apprentice training during the trainee's second year, since stipends are below productivity levels.

10. Environmental background variables, such as SES, caste, and religion, were mildly related to educational attainment, but weakly related to training path. Childhood residence was strongly related to educational attainment and to worker productivity: workers who grew up in farm villages were not only more educated but also more productive.

Conclusions and Implications Relevant to Methodology

In reporting the results of social science research, it is tempting to comment extensively on successful approaches and methods and quietly brush aside methodological problems that may have impeded the study's execution. However, some "methodological" difficulties may prove useful to report.

One difficulty concerned the desirable level of specificity in defining education, training, and experience as independent variables. It was found, for example, that months of training were not related to productivity but that training paths were. Had the study concentrated exclusively on quantities of training and ignored kinds of training paths, an important finding might have been overlooked. It would be interesting in future studies to categorize training paths by degrees of quality, which could be determined by per trainee capital equipment costs, SES environment, hours of instruction and practice, and levels of training of staff members, and to study the effects of qualitative differences on worker productivity.

Another interesting experience involved the use of subjective rating scales. A Likert scale incorporating 14 statements relevant to attributes of skilled workers (such as manual dexterity and mathematical ability) was designed, pretested, revised, and pretested again, and was then filled in by supervisors for all workers interviewed. It failed as a valid measure, despite a careful wording of statements, the briefing of raters, and an explanation of biases that might distort judgment. There was so much variation in the shape of the distribution of scores given by supervisors that it was virtually impossible to assess with any validity the relative degree to which each worker had certain attributes. Moreover, as mentioned in Chapter II, the supervisors' ratings of efficiency correlated only .5 with actual efficiency, a finding that cast serious doubt on their judgment of other attributes. Probably each supervisor used a different set of criteria and standards in evaluating workers, and could not be forced into the same frame of reference for our purposes. This experience may serve as a warning for researchers who rely on subjective ratings. It also underlines the importance of having some harder measure against which to validate rating scales.

A third experience with methodology concerned the assumed unidirectional relationship of independent and dependent variables: the assumption that changes in independent variables lead to changes in dependent variables but not vice versa. The fact is, there are often interactions between these two sets of variables. For example, job satisfaction and aspirations may affect efficiency, and efficiency may influence or reinforce job satisfaction or aspirations, which in turn may have a new effect on efficiency. Single-direction regression equations do not take such circular effects into account. Attempts are now being made to develop multiple equation models that take into account the passive and active functions of the dependent variable, and in future, statistical analyses based on these equations may yield more realistic explanations about variable relationships than do our present unidirectional ones.

Conclusions and Implications Relevant to Theory, Research, and Practice

The locus of specific job training. The proposition advanced by Becker, Staley, and others that specific job training is most effectively and efficiently provided within the employment system was supported by our finding that workers with in-employment training were better producers than those who had had mainly outside-employment training, represented by the ITIs, and that in-employment training was generally less costly. However, it might be argued that MACH workers with ITI training (at ENG there were only a few ITI alumni) are not the best ITI products, and that ITI graduates employed elsewhere might be excellent producers, even better than workers with in-firm training. However, it is doubtful that this is the case. MACH probably has been able to recruit from among the better trained ITI graduates, not only because its wages and fringe benefits are high compared to many other employing establishments in Bangalore, but also because of the attraction of job security that usually accompanies employment in a government enterprise. Therefore, we concluded that MACH workers with ITI training were in fact among the better ITI graduates.

Why are workers with in-employment training better producers? The reason for the superior performance of workers with mainly in-employment training remains obscure and an area calling for further research. But there are some clues. Since we found that the environmental backgrounds of workers in outside and inside training paths did not account for differences in worker productivity, and that there was little difference in trade knowledge and skills for workers with in-employment and outside-employment training, we assumed that both

paths contributed about equally to the development of trade expertise; or that initial differences were washed out by the year of in-firm training ITI graduates received at MACH, or by years of trade experience. In any case, differences in job performance did not seem to be related to different degrees of job knowledge and skills, or to environmental backgrounds.

We would guess that variance in productivity within a single occupational category is determined largely by attitudes, motivations, and behavior that are unrelated to trade knowledge and skills. This hypothesis was given support by supervisors, who believed that workers with mainly in-employment training were better workers because they had more job interest and motivation, more confidence in their skills, and were more regular in attendance. In unstructured interviews, MACH supervisors made other interesting observations about ITI graduates: that they had fixed notions about their work prior to entering the firm, making it difficult to "retrain" them to fit into MACH's peculiar production processes; and that they expected rapid promotion on the basis of their superior qualifications. (In fact, we have seen that they are promoted more rapidly than other workers.) These observations are recorded as examples of attitudes and behavior that may be affecting job performance. However, they require empirical verification. An interesting study would be to compare ITI-trained workers with those trained only within the company along a number of attitudinal and behavioral dimensions, including achievement motivation, cooperation with co-workers and supervisors, readiness to adopt new techniques, ease in handling new jobs, and so on. Such a study might establish that there are indeed substantial differences.

If our hypothesis is correct and attitudes do explain productivity differences, then attention might be given to modifying training curricula so that emphasis is not only on skill acquisition but also on the development of positive attitudes required for high levels of job performance, such as a sense of responsibility for tools, equipment and products, confidence in own skills, punctuality, and pride in quality craftsmanship.[1]

---

[1]Some experts in vocational-technical education and training have said that vocational-technical schools not only do not teach what is really needed, but "may even teach methods and attitudes that must be unlearned before he (trainee) can be effective in a job." See Marian Alexander-Frutschi, ed., Occupational Education and Training for Development: Account of an International Conference at Stanford (SIDEC, School of Education, Stanford University, 1968), p. 109.

Multiple approaches to trade training. The large number of training paths, of varying content and duration but all leading to the same skilled occupations, has some interesting implications. This situation probably reflects the diversity of resources firms and other agencies have available or are willing to allocate to training as well as the diversity of educational and environmental backgrounds of trainees. Perhaps an array of training schemes is required to accommodate the needs of employers and trainees with varying backgrounds, given available training resources.[1] This supposition argues for the support of multiple locally tailored programs to meet manpower needs, and not the support of only one or two standardized training schemes.

Flexible trade training. The high incidence of trade change among ITI graduates and its concommitant costs raise the question of whether ITI training should be more flexible and broadly based, rather than concentrating heavily on single trades. Perhaps ITIs could provide knowledge and skills common to several trades. For example, turning, milling, and grinding could be analyzed with a view to identifying common tasks. These tasks would suggest a "core" curriculum that all trainees could follow irrespective of the trade they eventually choose. Required training that is not part of the "core" might be left to employing establishments. This approach would not commit a trainee to a particular trade until he was actually employed, and cost savings would accrue from limiting training to a "core" curriculum instead of offering intensive training in several trades. Employing establishments would not necessarily have to incur heavy additional training costs, for it is likely that they are already giving considerable retraining to ITI graduates to acquaint them with their own particular production processes.

The "core" approach, which would place more emphasis on general theory, mathematics and science, could also be helpful to presently employed skilled workers who wish to upgrade and broaden their trade knowledge through evening courses (ITIs currently present evening classes).

The role of schools. We have suggested that specific job related knowledge and skills be left to employing establishments, and that the provision of knowledge and skills common to several trades

---

[1] In fact, staff of the Directorate of Employment and Training have clearly recognized that the role of ITIs should be to provide training in areas where firms do not have suitable resources to do so.

could be provided in training institutes. What then should be the role of the school? Our data on outside-employment training suggest that schools should not be involved in vocational training: it is expensive and not as effective as in-firm training, and commits a person to an occupation at a very young age and before he is employed. Generally speaking the school should teach people how to learn, so that they are trainable. More specifically, without changing its academic objectives, it can use occupationally oriented materials and practices in teaching many general subjects that would indirectly help young people get ready for occupational roles. For example, problems of measurement could be used to illustrate mathematics, or heat treatment of metals to demonstrate scientific principles.

An Occupational Training Organization (OTO). Of course, multiple approaches to trade training, the reorganization of ITI training, and the introduction of occupationally oriented materials in schools, would require the close cooperation of employers, schools, and training institutes, and hence some organizational machinery. Staley's concept of an Occupational Training Organization could serve this purpose. An OTO, managed by representatives of firms, unions, schools, training institutes, and other relevant government agencies, would study local manpower needs, allocate training functions to schools, institutes, and firms, train trade instructors and prepare training materials, establish training standards, and carry out research relating education and training to job performance in key occupations.[1]

Other Conclusions. Although the study focused on education and training and their relationship to worker productivity, its findings included some interesting peripheral information. The data clearly showed that workers with rural backgrounds were more educated and better producers than workers with town or city origins. This led to the hypothesis that persons moving out of rural areas to eventually find skilled industrial work are unusually gifted and extraordinary people, certainly by rural standards and probably by urban as well. It may also mean that some of the values and attitudes that are part of a rural heritage may be useful and compatible with factory work.

---

[1]Staley, op. cit., p. 128.

Conclusion

In seeking to answer questions about the relationship of education, training, and worker productivity, this study has raised many others. Nevertheless, its findings--that there are multiple approaches to trade preparation; that workers with mainly outside-employment training are less efficient than those with exclusively in-employment training; that despite a reduced level of productivity, workers with mainly outside-employment training are promoted more rapidly than workers with other forms of training; that education is positively but only weakly related to productivity; and that the differences in productivity between workers with primarily outside training and other workers seem to reflect differences in attitudes and behavior unrelated to job knowledge and skill--have hopefully shed further light on the body of theory surrounding education, training, and productivity.

These findings may also provoke questions about the direction of occupational education and training in India, where educators and economists are considering the following question: should secondary education be divided into technical and academic streams in the hope of encouraging and training young people for skilled and technical work, or should it be reformed by introducing occupationally oriented materials and experiences to which all secondary school students would be exposed, leaving training for the most part to the employment system? Assuming our data are generally valid, the second approach would seem more desirable.

BIBLIOGRAPHY

Alexander-Frutschi, Marian, ed. Occupational Education and Training for Development: Account of an International Conference at Stanford. Stanford International Development Education Center, School of Education, Stanford University, 1968.

Al-Bukhari, Najati M. A. Issues in Occupational Education and Training: A Case Study in Jordan. Stanford International Development Education Center, School of Education, Stanford University, 1968.

Anderson, A. C. and Bowman, M. J. (eds.) Education and Economic Development. Chicago, 1965.

Ashby, Eric. Universities: British, Indian, African: A Study in the Ecology of Higher Education. London, 1966.

Becker, Gary. Human Capital: A Theoretical and Empirical Analysis with Special Reference to Education. New York, 1964.

Bierman, Harold and Smidt, Seymour. The Capital Budgeting Decision. New York, 1961.

Blaug, Mark. A Cost-Benefit Approach to Educational Planning in Developing Countries. IBRD, 1967.

Blaug, Mark. Economics of Education: A Selected Annotated Bibliography. Oxford, 1966.

Blaug, Mark, Layard, P. R. G. and Woodhall, M. The Causes of Educated Unemployment in India. London, 1964.

Borow, Henry, ed. Man in a World of Work. Boston, 1964.

Bowen, W. G. "Assessing the Economic Contribution of Education: An Appraisal of Alternative Approaches," Economic Aspects of Higher Education. OECD, Paris, 1964.

Bowman, M. J., et al. (eds.). Readings in the Economics of Education. UNESCO, Paris, 1968.

Brand, W. Requirements and Resources of Scientific and Technical Personnel in Ten Asian Countries. UNESCO, Paris, 1960.

Brown, Phelps. The Economics of Labour. New Haven, Conn., 1964. See section dealing with caste and occupational mobility.

Bruton, Henry J. Principles of Development Economics. Englewood Cliffs, New Jersey, 1965. See chapter on "The Training of Labour," pp. 205-240.

Burgess, Tyrell and Layard, Richard and Pant, Pitambar. Manpower and Educational Development in India (1961-1966). January, 1966. (Mimeo.)

Carnoy, M. and Thias, Hans. Cost-Benefit Analysis in Education: A Case Study of Kenya. IBRD, Washington, D. C., 1969.

Carnoy, Martin. The Returns to Schooling in Mexico: A Case Study. Unpublished Ph.D. dissertation, University of Chicago, 1964.

Chandrakant, L. S. Fourth Five Year Plan of Technical Education, A Draft Report. Ministry of Education, New Delhi, 1965.

Chopra, V. K., et al. Critical Analysis of Efficiency in Turning Trades and its Comparison with That in Other Trades. Hindustan Machine Tools, Ltd., Bangalore, 1968.

Corazzini, A. J. Vocational Education: A Study of Benefits and Costs. Princeton, New Jersey, 1966.

Davie, Bruce F. Using Cost-Benefit Analysis in Planning and Evaluating Vocational Education. USOE, 1965. (Processed)

Datar, B. N. "Manpower Planning in India," International Labour Review, Vol. DXXVIII, No. 1, July, 1958. Considers the use of unemployed manpower.

Denison, E. F. "Measuring the Contribution of Education to Economic Growth," The Residual Factor and Economic Growth. OECD, Paris, 1964.

Dorfman, Robert, ed. Measuring Benefits of Government Investments. Brookings Institution, Washington, D. C., 1963.

Driver, E. D. "Caste and Occupational Structure in Central India," Social Forces, XLI, October, 1962.

Education Commission. Socio-Economic Backgrounds of Students Admitted to Institutions of Professional, Technical and Vocational Education, 1965. New Delhi, 1966.

Engineering Association of India. India's Engineering Industries. Calcutta, 1966.

Eninger, M. U. Process and Product of Trade and Industrial High School Level Vocational Education in the United States, Vols. I and II. Educational Systems Research Institute, Pittsburgh, 1968.

Feldman, M. J. "Making Education Relevant," The Ford Foundation, adapted from a paper prepared for the Governor's Conference on Education, State of New Jersey, Rutgers University, April 2, 1966.

Fenske, R. W. "An Analysis of the Meaning of Productivity," Productivity Measurement Review, No. 4 (August, 1965).

Fortin, B. "Education and Training Programmes," Human Resources for Industrial Development. ILO, Geneva, 1967.

Foster, Philip J. "The Vocational School Fallacy in Development Planning," in Anderson, Arnold and Bowman, Mary Jean (eds.) Education and Economic Development. Aldine, 1965.

Griliches, Zvi. "Notes on the Role of Education in Production Functions and Growth Accounting." Paper presented at the Conference on Research on Income and Wealth, Madison, Wisconsin, November 15-16, 1968.

Hanson, A. H. The Process of Planning: A Study of India's Five Year Plans, 1950-1964. London, 1967.

Harbison, Frederick, and Myers, Charles A. Education, Manpower and Economic Growth. New York, 1965.

Hollingshead, August B. Two Factor Index of Social Position. New Haven, Conn., 1957.

Hoppock, Robert. Occupational Information. New York, 1967.

Horowitz, Morris. Appraisal of Brazilian Intensive Vocational Training Programme, Report and Methodology. CINTERFOR, 1967.

Horowitz, M. A., and Herrnstadt, I. L. "The Training and Education of Tool and Die Makers," Proceedings of the Industrial Relations Research Association, Winter, 1967, pp. 15-24.

Hyman, Herbert. Survey Design and Analysis: Principles, Cases and Procedures. New York, 1955.

ILO. Human Resources for Industrial Development. Geneva, 1967. See second two articles by B. Fortin, "Education and Training Programmes," and "The Effective Utilization of Manpower for Industrialization," pp. 53-133.

India, Government of. Annual Survey of Industries 1963. Central Statistical Organization, Vol. VII, Calcutta, 1965.

_____. Facilities of Technical Education in India. Vol. I, Diploma and Certificate Courses. Ministry of Education, New Delhi, 1965.

_____. Handbook on Training Facilities in Delhi. Ministry of Labour and Employment, 1965.

_____. National Classification of Occupations. Ministry of Labour and Employment, 1958.

_____. Report of the Secondary Education Commission. Ministry of Education, New Delhi, 1965.

_____. Report of the Progress in Craftsmen and Other Training Programmes of the DGET up to March, 1966. Directorate General of Employment and Training, New Delhi, 1967. (Mimeo.)

_____. Report on the Pattern of Graduate Unemployment. Directorate General of Employment and Training, New Delhi, 1963.

_____. The Apprentices Act, 1961. Directorate General of Employment and Training, Ministry of Labour and Employment, New Delhi, 1963.

_____. Report of the Education Commission, 1964-1966. Ministry of Education, New Delhi, 1966.

_____. Summaries of Reports on City Surveys. Planning Commission, 1957.

Institute of Applied Manpower Research. A Guide to Education and Training Statistics. Working Paper No. 6, 1967.

James, Ralph C. "Labour Mobility, Unemployment and Economic Change: An Indian Case," Journal of Political Economy. (December, 1959).

_____. "The Casual Labour Problem in India Manufacturing," The Quarterly Journal of Economics. (February, 1960).

Kabir, Humayum. Education in New India. London, 1959.

Kahl, Joseph. Measurement of Modernization. New York, 1968.

Karve, I. Hindu Society: An Interpretation. Poona, 1961.

Kuchhal, S. C. The Industrial Economy of India. Allahabad, 1969.

Katz, D. and Kahn, R. L. The Social Psychology of Organizations. New York, 1967.

Khushdel, M. "Problem of Crafts in Basic Education," Educational Psychology, I, 1954.

Lambert, Richard D. Workers, Factories and Social Change in India. Princeton, 1963.

Laska, John A. Planning and Educational Development in India. Columbia University, New York, 1968.

Leagan, J. P. India's Experience with Training in Extension Education for Community Development. Ford Foundation, 1961.

Lee, Moon Yong. A Study of the Effectiveness of Vocational and Technical Education in India. Asian Institute of Educational Planning and Administration, 1968. (Unpublished manuscript).

Leff, Nathaniel. The Brazilian Capital Goods Industry: A Case Study in Industrial Development. Unpublished Ph.D. dissertation, MIT, 1965.

Leonard, J. Paul. The Development of the National Institute of Education. USAID, New Delhi, 1967.

Lewis, J. P. Quiet Crisis in India. Brookings Institution, 1964.

Lydall, Harold. The Structure of Earnings. Oxford, 1968.

Majumdar, D. N. Employment Among the University Educated: A Pilot Inquiry in India. MIT, 1957.

Maley, Donald. An Investigation and Development of the Cluster Concept as a Program in Vocational Education at the Secondary School Level. Industrial Education Department, Maryland, 1966.

Maton, J. "Experience on the Job and Formal Training as Alternative Means of Skill Acquisition: An Empirical Study," International Labour Review (September, 1969), pp. 239-257.

Mincer, J. "On-the-Job Training: Costs, Returns and Some Implications," Journal of Political Economy, Vol. LXX (October, 1962), Part 2, pp. 50-79.

Misra, A. Educational Finance in India. London, 1962.

Moore, Wilbert and Feldman, A. Labor Commitment and Social Change in Developing Areas. New York, 1960.

Mukerji, S. N. Education in India Today and Tomorrow. Baroda, 1964.

Myers, Charles. Labor Problems in the Industrialization of India. Cambridge, Mass., 1958.

Mysore, Government of. Employment Review, Mysore State. The Directorate of Employment and Training, Bangalore, 1968.

_____. Shortage Occupations, Mysore State. The Directorate of Employment and Training, Bangalore, 1967.

Nurullah, Syed and Naik, J. P. A History of Education in India. Bombay, 1951.

OECD. Mathematical Models in Educational Planning. Paris, 1967.

Ornati, O. Jobs and Workers in India. Cornell, 1955.

Pandit, H. N. A Study in Unit Costs at School Stage in India. Economics of Education Unit, Department of Foundations of Education, National Institute of Education, New Delhi, 1968.

Perlman, Richard. Labor Theory. New York, 1969.

Ramanadham, V. V. Incentives in Public Enterprise, Seminar Papers and Proceedings. Hyderabad, 1967.

Rao, B. S. Venkata. Education and Training for Industrial Development in India. Stanford International Development Education Center, School of Education, Stanford University, 1969.

Robinson, Harry. Industrial Development Policy in India. Stanford Research Institute, 1956.

Rosen, George. Democracy and Economic Change in India. Los Angeles, 1967.

Schultz, T. W. "Capital Formation by Education," Journal of Political Economy, LXVIII, 1960, pp. 571-583.

_____. "Education and Economic Growth," in N. B. Henry, ed., Social Forces Influencing American Education. Chicago, 1961.

_____. The Economic Value of Education. New York, 1963.

Selltiz, Clair and Jahoda, Marie, and Deutsch, Morton and Cook, Stuart. Research Methods in Social Relations. New York, 1966.

Shartle, Carroll. "Occupational Analysis, Worker Characteristics, and Occupational Classification Systems," in Borow, ed., Man in a World of Work. Boston, 1964.

Shri Ram Centre for Industrial Relations. "Inter-Industry Wage Structure in India, 1950-1961, An Analysis," Indian Journal of Industrial Relations, Vol. I (April, 1966), No. 4, pp. 377-414.

Sims, A. Ray. Polytechnic Education in India, A Critical Evaluation. USAID, New Delhi, 1963.

Singer, Milton. "Cultural Values in India's Economic Development," The Annals of the American Academy of Political and Social Science, CCCV, May, 1956.

Singh, Baljit. Education as an Investment. Delhi, 1961.

Sreenivisan, K. Productivity and Social Environment. Bombay, 1964.

Staley, E. Planning Occupational Education and Training for Development. Stanford International Development Education Center, School of Education, Stanford University, 1968.

Taira, Koji. "Wage Differentials in Development Countries," International Labour Review (March, 1966).

Tobias, George and Queener, Robert S. India's Manpower Strategy Revisited, 1947-1967. Bombay, 1968.

Turner, Roy, ed. India's Urban Future. University of California, Berkeley, 1962.

UNICEF. Children and Youth in National Planning and Development in Asia, Report of a Conference, Bangkok, Thailand, March, 1966. New York, 1966.

United Nations Research Institute for Social Development. Cost-Benefit Analysis of Social Projects. Geneva, 1966.

United States, Government of. Dictionary of Occupational Titles, Vol. I, Definition of Titles; Vol. II, Occupational Classification and Industry Index, Department of Labor. Government Printing Office, Washington, D. C., 1965.

Vaisey, John. The Economics of Education. New York, 1962.

Weisbrod, Burton. "The Valuation of Human Capital," Journal of Political Economy (October, 1961).

Young, Robert. Planning for Technical Education in the CMD, An Outline. Ford Foundation, New Delhi, January 1967.

Zaleznik, A. Worker Satisfaction and Development, A Case Study of Work and Social Behavior in a Factory Group. Harvard University, Graduate School of Business Administration, Boston, 1956.

APPENDIX I

A WORKER CHARACTERISTIC RATING SCALE

Supervisors completed a rating form for each turner, miller, and grinder under their supervision. They were asked whether they strongly agreed, agreed, were undecided, disagreed, or strongly disagreed with each of the statements given below.

1. This worker learns quickly new jobs.
2. He is able to use his hands with skill and accuracy.
3. He is excellent in reading and comprehending blueprints.
4. His knowledge of tools and machines is poor and he frequently requires supervisory help.
5. His understanding of trade theory is excellent.
6. He is fast and accurate in workshop calculations.
7. He is innovative and imaginative in finding faster and more efficient ways of doing his job.
8. His attitude toward supervision is poor.
9. This worker takes keen interest in his work.
10. He faces difficult jobs with the confidence that he can do them well.
11. This worker's attendance is regular.
12. He has good physical endurance and hardly ever loses time because of health problems.
13. This worker's efficiency is low.
14. His quality of work is excellent.

APPENDIX II

QUESTIONNAIRE FOR SUPERVISORS

1. Name ..... T. No. .....Section No. .....

2. Age at last birthday ..... Religion .....Caste.....

3. Mother tongue ..... Read .....Write.....

   (Put ✓ to show whether you speak, read, or write this language)

4.

Other languages	Speak	Read	Write

5. Education:

Type/School	Place and State	No. of years attended	Please check ✓ whether passed or failed: Passed (give type certificate or degree)	Failed	Main Subjects
Primary					
Middle School					
High School					
Intermediate or P.U.C.					
University					
Other (specify)					

6. Training:

	Name of Institute or firm	Place and State	Month/ Year Started	Month/ Year Ended	Please check ✓ whether passed or failed: Passed	Failed	Field of Training
Polytechnic							
I.T.I.							
A.T.C.							
A.T.B.							
Technical Training							
Other on-the-job training							
Deployment training							
Other (specify)							

7. Before being employed by your present firm what jobs did you have in other firms or enterprises?

	Kind of enterprise (what did they make or do)	Place/ State	Trade OR kind of job	Years		Monthly wage and allowances
				From	To	
1st						
2nd						
3rd						
4th						
5th						

8. Jobs held in present firm:

	Type of job	Trade	Designation	Section	Years		Wage Grade
					From	To	
1st							
2nd							
3rd							
4th							
5th							
6th							

9. How many years have you held a supervisory position in your present company? .....

Before coming to your present company? .....

10. Did you ever have any specific training in supervisory techniques?

Yes ..... No ..... If yes, where ..... for how long

..... and in what subjects .....

11. What is your opinion of I.T.I. training?

Good .....

Fair .....

Bad .....

No opinion .....

Please state why? .....

.....

12. What is your opinion of the full three year apprentice training programme?

Good .....

Fair .....

Bad .....

No opinion .....

Please state why? .....

.....

13. What is your opinion of the company's in-firm training programme to train turners, millers, and grinders?

Good .....

Fair .....

Bad .....

No opinion .....

Please state why? .....

.....

14. Generally which of the workers under your supervision are more efficient in their work?

1. Those who attended 18 months of I.T.I. training plus one year of A.T.C. .....
2. Those who underwent in-firm training in the factory .....
3. Those who completed the Government industry sponsored three-year full apprentice training programme .....
4. Those who have had polytechnic training plus one year of A.T.C. .....
5. Those who picked up their trade through observation and job experience and who had a high school education .....

6. Those who picked up their trade through observation and job experience and who did not have a high school education .....

Why do you think these workers are more efficient? Please tick (✓) just the most important reasons:

1. learn aspects of work more easily .....
2. have more trade theory knowledge .....
3. have more practical experience with tools and equipment .....
4. are better at using their hands .....
5. are better in reading blue prints .....
6. are better at workshop calculations .....
7. have more confidence in their skills .....
8. are more dependable in turning out good work on time .....
9. have better attitude .....
10. other reasons (please specify) .....

15. Are you generally satisfied with the present incentive system?

Yes ..... No ..... If no, why not? .....

.....

.....

16. What type of incentive system would you prefer? .....

Please state why .....

.....

17. If there is a vacancy for promotion in skilled worker grades, what do you think should be the most important <u>three</u> factors in considering a worker for promotion? Please put 1 next to most important, 2 next to second most important, etc.

Seniority .....

Efficiency .....

Good co-operation with supervisor .....

Level of schooling attained .....

Kind of training had .....

General conduct .....

Attendance .....

Others (specify) .....

18. In your understanding, on what basis do you think promotions in skilled worker grades are given in your section?

.....

.....

19. Which four of the following characteristics do you think are most important for good work for workers under your supervision? Put 1 next to most important, 2 next to second, etc.

1. ability to learn quickly .....
2. trade theory knowledge .....
3. ability to use hands well .....
4. practical knowledge of tools and equipment .....
5. ability to read blue prints .....
6. ability to do workshop calculations .....
7. technical imagination and ability to innovate .....
8. good conduct .....
9. job interest .....
10. confidence in own skill and abilities .....
11. physical endurance .....
12. good attendance .....

APPENDIX III

INTERVIEW SCHEDULE FOR WORKERS

I. Personal Data:

1. Name ..... T. No. .....Section.....Trade.....

2. Caste .....Sub-caste .....

3. Mother Tongue .....Read .....Write .....

4.

Other Languages	Speak	Read	Write

II. Family Data:

5. Relatives living under same roof (specify number):

Wife ..... Sons ..... Daughters ..... Father ..... Mother .....

Grand Parents ..... Brothers ..... Sisters..... Brother's

wives ..... Brother's children ..... Other relatives (specify

relationship and numbers) .....

.....

6. Number of income earners among above relatives .....

7. Estimated total income of household per month, including worker's wages Rs. .....

8.

	Age	Occupation and Industry	Level and Years of Schooling	Certificate		Training
				P	F	
Father						
Brothers 1						
2						
3						
4						
Sons 1						
2						
3						
4						

III. Migration Data:

9. Have you lived in Bangalore all your life? Yes ..... No .....

If no, when did you come? .....

10. Other places lived in:

Place and State	Years		Were you living in a		
	From	To	Farm Village	District Town	Main City

IV. Education and training:

11. Education:

Type/School	Place and State	No. of years attended	Passed (give type certificate)	Failed	Main Subjects
Primary					
Middle School					
High School					
Junior Technical School					
P.U.C.					
University					
Other (specify)					

12. Training:

	Name of Institute or firm	Place and State	Month/ Year Started	Month/ Year Ended	P	F	Field of Training
Polytechnic							
I.T.I.							
A.T.C.							
In-firm training							
Apprentice training							
Other (specify)							

NOTE: Questions 13 - 20 are only for I.T.I. or Apprentice Training.

13. Do you have a National Trade Certificate? Yes ..... No .....

If yes, when did you pass the test? ..... and where? .....

14. Do you have an Apprentice Trade Certificate? Yes ..... No .....

If yes, when did you pass the test?..... and where? .....

15. How important were the following in preparing you for present job:

	Most Helpful	Helpful	Not So Helpful
I.T.I.			
Apprentice Training			
Previous Work Experience			
On-the-job Training			

16. Did someone advise you to take I.T.I. or apprentice training?

Yes ..... No ..... Who?

School teacher .....

Working friends .....

Friends who had taken I.T.I. or apprentice training .....

Family members (specify which) .....

Others (specify) .....

17. What did you hope to gain from I.T.I. or apprentice training?

Chances for advancement and promotion .....

So could do job better and more easily .....

Get industrial job .....

Increased wages .....

No special reason .....

Other reasons (specify) .....

18. In looking back over your I.T.I. or apprentice training, which of the following seemed <u>essential</u>, <u>helpful</u>, and <u>not so helpful</u> in preparing you for your present job?

	Essential	Helpful	Not so helpful
Trade theory: For example, purposes of tools and equipment, safety precautions;			
Practical instruction: Making parts and construction, using tools and equipment;			
Engineering drawing and reading;			
Workshop calculations;			
Workshop science: For example, heat treatment of metals, metal composition			

19. On the basis of your experience in the I.T.I. or with apprentice training and in view of the requirements of your present job, what suggestions would you have to improve I.T.I. or apprentice training in your trade?

.....

.....

20. How has I.T.I. or apprentice training helped you?

Helped me get promoted .....

Helped me earn more .....

Enabled me to get transferred to a new job .....

Other ways (specify) .....

21. How did you hear about and obtain your first job in the present firm?

Employment Exchange .....

Newspaper advertisement .....

Personal initiative .....

Father's help .....

Relatives (specify which) who were working in the company .....

Working friends in the company .....

Help of I.T.I. or apprentice training staff .....

School teacher .....

With union help .....

Other ways (specify) .....

22. Were you ever a farmer? Yes ..... No ..... If yes, during which years ..... Are any of your relatives presently farming? Yes ..... No ..... If yes, specify which relatives and where .....

.....

23. Before being employed by your present company what jobs did you have in other firms or enterprises? Give only jobs held for more than six months:

	Kind of enterprise (what did they make or do)	Place/ State	Occupation	Type of job	Years		Estimated monthly wage and allowances
					From	To	
1st							
2nd							
3rd							
4th							
5th							

24. Jobs held in present company:

	Type of job	Department	Years
1st			
2nd			
3rd			
4th			

V. Job aspiration and career improvement data:

25. If the company continues to do well, what jobs do you think you might have in:

ENG	MACH	2 Years	5 Years	Just before you retire
Worker	WS4			
Skilled worker	WS5			
Skilled worker	WS6			
Highly skilled worker	WS7			
Assistant supervisor	CB			
Supervisor; Junior foreman				
Foreman	Foreman			
Work super-intendent; Manager				

26. What would be necessary for you to get these jobs?

Further experience in your present job? Yes ..... No .....

More training? Yes ..... No ..... If yes, training in which fields? .....

27. In choosing a job which of the following would seem most desirable?

Guaranteed job with good starting pay but limited chances for promotion .....

Jobs which may not be permanent but with very high pay and chances for rapid promotion .....

Guaranteed job with low starting pay but reasonable chances for promotion .....

VI. Job satisfaction:

28. If you could earn a good living in each of the following, which would you like best? Second best? Third best?

	Best	Least
Farmer with own land		
Self-employed in own shop		
Skilled factory worker		
Office worker		
Other (specify)		

Why? .....

29. How would you answer the following?

	Strongly Agree	Agree	Un-decided	Dis-agree	Strongly Disagree
When you do good work you get recognition and encouragement from your supervisors.					
You find the technical supervision in your section helpful and satisfactory.					
Your co-workers see eye to eye with you on things relating to the every day operation of the section.					
The jobs you get are challenging and give you the chance to apply your skills.					
You have confidence in the management's policies.					

30. Do you feel that the ability of your co-workers is:

Excellent .....

Slightly above average .....

Average .....

Slightly below average .....

Poor .....

31. Are your working conditions comfortable and healthful?

Why .....

Yes, excellent .....

Slightly above average .....

Average for type of work .....

Slightly below average .....

No, poor .....

32. Is your income adequate for your living needs?

Yes, even provides for several luxuries .....

Provides more than average comfort .....

Provides average comfort .....

Barely enough to get by on .....

Less than enough to get by on and has to be supplemented by other sources .....

33. Is there a bonus incentive scheme in your department? Yes .....

No ..... If yes, what do you think was management's purpose in introducing such a system? First purpose .....

..... Second purpose .....

34. Approximately how much incentive pay do you expect to make each month? .....

35. In your department do you think all workers have equal chances to earn incentive pay? Yes ..... No ..... If no, why not?

.....

36. In your view, are the time standards for tool room jobs accurate and fair? Yes ..... No ..... If no, do you find inaccuracies in set-up timings ....., machining timings ....., or both .....?
In which aspects of set-up work or machining do standards seem to be most unreliable? .....

37. Are you generally satisfied with the incentive scheme? Yes ..... No ..... If no, why not? .....
What suggestions would you have for improving the scheme?
.....

38. If you have a grievance, to whom do you go? .....

39. What types of grievances are most common?
.....

VII. Views on advancement opportunities:

40. In getting promoted, what do you think should count most?
Second most?

Seniority .....

Job efficiency .....

Good co-operation with supervisor .....

Level of schooling attained .....

General conduct .....

Kind of training had before joining your present company .....

Kind of experience had before joining present company .....

Other (specify) .....

41. On what basis do you think promotions are made in your department? .....

42. Do you find the present regulations governing promotion satisfactory? Yes ..... Not altogether ..... What suggestions would you have for improving these regulations?

.....

APPENDIX IV

CASTES AND SUBCASTES, MACH WORKERS[1]

MAIN CASTES:

BRAHMIN (religious)	LINGAYAT	KSHATRIYA (warriors)	VAIYSA (commerce)	SUDRA (workers)	UN-SCHEDULED

SUBCASTES:

Veerashiva	Nair	Chetty	Vokkaliga
	Ursu	(traders)	(tillers)
	Rajput	Kaniya	Gounder
	Coorgi	(bankers)	(tillers)
			Reddy (tillers)
			Gowda (tillers)
			Gangdikar (tillers)
			Tigla (gardners)
			Besta (fishermen)
			Bhajantri (barbers)
			Pillai
			Mochi (cobblers)
			Kuruba (shepherds)
			Baliga
			Naik (hunters)
			Darji (tailors)
			Kumbara (potters)
			Sourastra (weavers)
			Valmiki (hunters)
			Yadava (cowherds)
			Achar (goldsmiths)
			Naidu
			Idiga (toddy makers)
			Raju (wrestlers)

---

[1]Prepared with the help of the National Institute of Social Science, Bangalore. Some traditional subcaste trades are included in parentheses.

POOR ORIGINAL COPY - BEST AVAILABLE AT TIME FILMED

APPENDIX V

PERCENTAGE DISTRIBUTION OF HOW JOBS WERE FOUND IN MACH AND ENG

	MACH (514)	ENG (84)
Employment Exchange	1.0%	0.0%
Newspaper advertisement	47.0	32.1
Personal inquiry	6.0	13.1
Father's help	1.7	0.0
Relatives in company (excluding father)	2.5	1.2
Friends in the company	9.6	45.2
Help of staff of training institutes	29.2	3.6
Union help	0.2	0.0
Did not say	2.8	4.8
Total	100.0%	100.0%

APPENDIX VI

PERCENTAGE DISTRIBUTION OF WORKERS BY RELATIVES LIVING IN THE SAME HOUSE

	MACH (511)	ENG (82)
Father	38.0%	27.4%
Mother	56.0	50.0
Wife	81.0	75.0
Brothers (one or more)	45.0	47.0
Sisters (one or more)	29.0	34.5
Sisters-in-law	13.0	6.0
Sons	52.0	49.0
Daughters	55.0	51.2
Brothers' children	8.0	6.0
Sisters' children	4.0	4.8
Grandmother	4.0	4.8
Grandfather	0.7	1.2
Brother-in-law	3.0	6.0
Cousins	3.0	4.8
Aunts	1.5	6.0
Uncles	2.5	3.6
Father-in-law	0.5	1.2
Mother-in-law	1.5	7.2

APPENDIX VII

TRAINING PATHS REPRESENTED AMONG MACH AND ENG WORKERS

Note:

ITI	Industrial Training Institute
ATC	Artisan Craftsmen Training offered in MACH
POLY	Polytechnical Institutes
FAT	Full apprentice training
LRN	In-firm learning
DPY	Deployment training (in-firm learning at MACH)
REF	Refresher training to renew skills
PUP	"Picking up" the trade

ITI				LRN	ATC			PUP	
ATC				LRN	ITI	ATC		PUP	POLY
POLY	ATC			LRN	FAT			PUP	ITI
ITI	ATC			ITI	REF			PUP	ITI	ATC
POLY	ITI	ATC		ITI	ATC	REF		PUP	FAT
FAT				FAT	REF			PUP	LRN
POLY	FAT			LRN	REF			PUP	REF
FAT	ATC			DPY				PUP	REF	ITI	ATC
ITI	ATC	FAT		DPY	POLY			PUP	LRN	REF
LRN				ITI	DPY			PUP	DPY
LRN	POLY			LRN	DPY			PUP	DPY	LRN
LRN	ITI			POLY	LRN	DPY			

APPENDIX VIII

THE RELATIONSHIP OF EFFICIENCY AND YEARS OF EDUCATION, MONTHS OF TRAINING, YEARS OF TRADE EXPERIENCE, AND OTHER VARIABLES

	MACH		ENG	
Variables	B	R^2 change	B	R^2 change
Years of education	0.721	.020	0.700	.020
Months of training	0.033	.001	-0.102	.006
Years of trade experience	-0.279	.003	0.566	.003
Age	0.150	.001	-0.025	.005
SES	-0.975	.030	--	--
Job Satisfaction	-1.201	.020	1.136	.008
Job Aspirations	.453	.003	-0.999	.003
Caste[a]				
Brahmin	-2.183	.002	--	--
Lingayat	-5.340	.003	--	--
Kshatriya	--	--	--	--
Vaisya	2.210	.001	--	--
Non-caste	-0.872	.001	--	--
Schedule	-3.334	.003	--	--
Religion[b]				
Catholic	-6.022	.006	--	--
Protestant	-6.548	.005	-42.760	.09
Muslim	1.469	.008	- 2.288	.007
Environment[c]				
Farm	2.282	.003	4.400	.002
City	--	--	-8.620	.04
Dependency Ratio	--	--	-0.341	.004
Constant	63.06		88.98	

[a]Relative to Sudras.

[b]Relative to Hindus.

[c]Relative to towns.

Significant at P .05.

APPENDIX IX

RELATIONSHIP OF EFFICIENCY AND TRAINING PATH AND OTHER VARIABLES

Variables	MACH B	MACH R^2 Change	ENG B	ENG R^2 Change
Training[a]				
Path 1	--	--	7.168	.003
Path 2	6.21	.02		
Path 3	7.11	.006	1.08	
Years of education	1.02	.01	1.090	.005
Years of trade experience	-0.71	.03		
Wage grade	5.57	.04	3.075	.006
SES	-1.02	.04	-0.422	.001
Job Satisfaction	-1.20	.02	1.090	.007
Job Aspirations	.27	.001	-1.240	.010
Religion[b]				
Catholic	-3.87	.007		
Protestant	-0.78	--	-39.450	.09
Muslim	3.58	.003		
Caste[c]				
Brahmin	-2.17	.001		
Lingayat	-3.16	.002		
Kshatriya	--	--		
Vaisya	--	--		
Schedule	-3.58	.002		
Non-caste	-3.84	.002		
Environment[d]				
Farm	2.11	.003	3.910	.002
City	-0.31	--	-9.186	.04
Constant	53.90		62.79	

[a]Relative to Path 1.

[b]Relative to Hindu.

[c]Relative to Sudra.

[d]Relative to town.

Significant at P .05.

APPENDIX X

RELATIONSHIP OF EFFICIENCY AND TRAINING PATH FOR MACH AND ENG WORKERS WITH 0-8 YEARS OF EDUCATION

	MACH (N 59)		ENG (N 25)	
Variables	B	R^2 change	B	R^2 change
Training Path[a]				
Path 2	-8.52	.04	10.23	.11
SES	-3.17	.06	.84	.004
Religion[b]				
Catholic	-12.04	.02	-17.89	.13
Protestant	--	--	--	--
Muslim	- 1.40	--	- 8.44	.005
Caste[c]				
Brahmin	- 3.40	.001	--	--
Lingayat	0.20	.005	--	--
Kshatriya	- 4.07	.007	--	--
Schedule	-23.20	.06	--	--
Non-caste	- 0.98	.001	--	--
Childhood residence[d]				
Farm	- 7.99	.04	23.27	.07
City	3.47	.006	-5.33	.013
Constant	79.48		73.83	
Total Variance		.24		.332

[a]Relative to Path 3.

[b]Relative to Hindu.

[c]Relative to Sudra.

[d]Relative to town.

Significant at P .05.

APPENDIX XI

RELATIONSHIP OF EFFICIENCY AND TRAINING PATH FOR MACH AND ENG WORKERS WITH 9-11 YEARS OF EDUCATION

	MACH (N 308)		ENG (N 40)	
Variables	B	R^2 change	B	R^2 change
Training Path[a]				
Path 1	--	--	- 0.61	--
Path 2	4.85	.03	1.19	--
Path 3	-0.14	--		
SES	-0.81	.03		
Religion[b]				
Catholic	-1.51	.005		
Protestant	-0.78	.002		
Muslim	3.47	--		
Caste[c]				
Brahmin	-3.49	.001		
Lingayat	-8.29	.01		
Kshatriya	0.38	.001		
Schedule	-1.46	--		
Non-caste	-5.80	.01		
Childhood residence[d]				
Farm	4.79	.03		
City	-2.22	.003		
Constant	66.24		84.61	
Total Variance		.122		

[a]Relative to Path 1.

[b]Relative to Hindu.

[c]Relative to Sudra.

[d]Relative to town.

Significant at P .05.

APPENDIX XII

RELATIONSHIP OF EFFICIENCY AND TRAINING PATH FOR MACH WORKERS WITH 12 AND MORE YEARS OF EDUCATION

	MACH (N 45)	
Variables	B	R^2 change
Training Path[a]		
Path 1	--	--
Path 2	4.15	.002
Path 3	13.44	.02
SES	-3.42	.134
Religion[b]		
Catholic	-28.56	.126
Protestant	- 4.83	.01
Muslim	4.21	.001
Caste[c]		
Brahmin	5.58	.001
Lingayat	11.59	.036
Kshatriya	7.91	.024
Schedule	- 6.88	.002
Non-caste	0.10	.001
Childhood residence[d]		
Farm	-10.80	.08
City	3.32	.007
Constant	77.71	
Total Variance Explained		.444

[a]Relative to Path 1.

[b]Relative to Hindu.

[c]Relative to Sudra.

[d]Relative to town.

Significant at P .05.